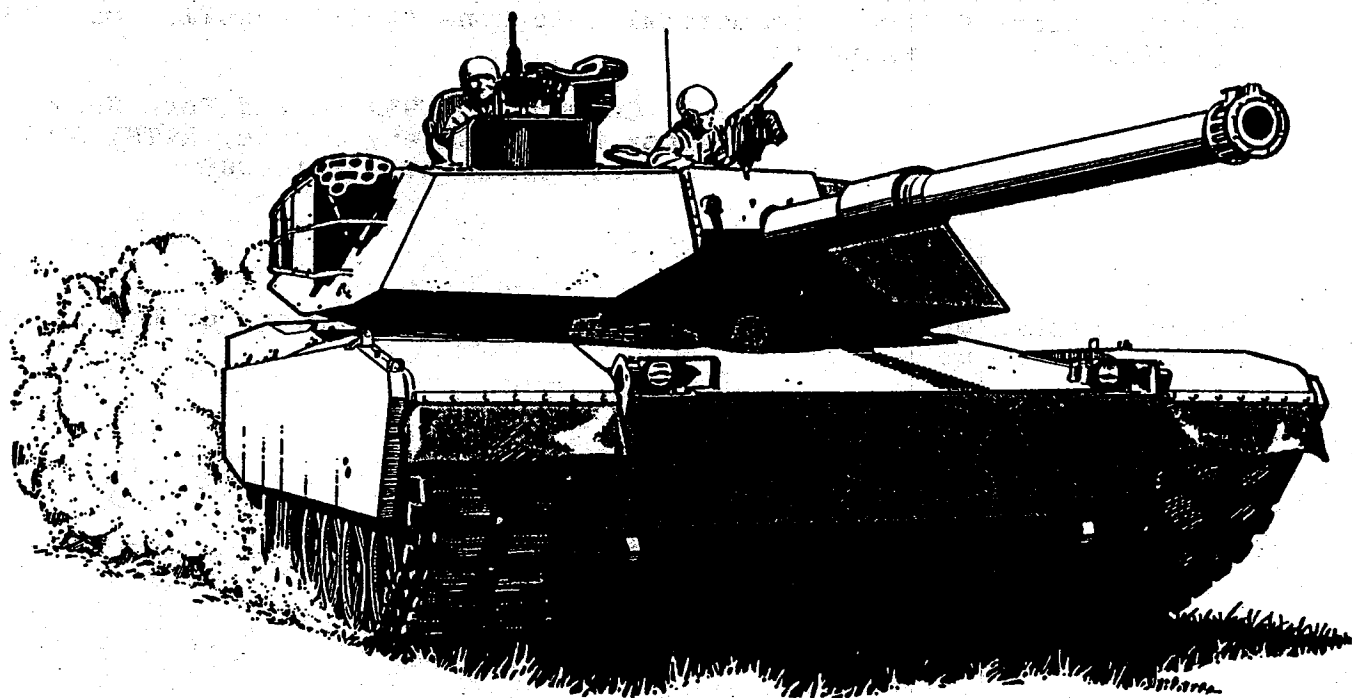


# **SAFETY TIPS FOR ARMOR LEADERS**



## ARMOR BRANCH SAFETY OFFICE

### SAFETY TIPS FOR ARMOR LEADERS

#### INTRODUCTION

This handbook is published as an aid for today's Armor leader. The many articles and extracts have been assembled in the hope that the collection will serve as a reference and guide to improve safety within Armor units.

Safety is an area that can be overlooked until it's too late. All too often safety becomes a hot topic after someone is killed or seriously injured. Safety should be integrated into everything we do. Although a strong safety program does not readily reveal how many lives it has saved, such uncertainty is far preferable to the clear costs of an ineffective or nonexistent program.

The primary source for the handbook has been Countermeasure, a publication from the U.S. Army Safety Center. You can order Countermeasure through your unit publication clerk.

Should anyone have questions or comments on this material or wish to submit additions, we encourage you to contact the Armor Branch Safety Office, commercial telephone (502)624-3811, or DSN 464-5452/3811, or write to:

Commander, USAARMC and Fort Knox,  
Armor Branch Safety Office, ATTN: ATZK-S  
Fort Knox, KY 40121-5000

Unless stated otherwise, masculine nouns and pronouns do not refer exclusively to men.

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# **CHAPTER 1**

## **ACCIDENT PREVENTION AND RISK MANAGEMENT**



# RISK MANAGEMENT

# Accident prevention planning

Unit leaders must take the initiative in making safety just as much a part of being a tanker, as gunnery, or maintenance. How can you do this in your unit?

Identify the problems. Find out what causes the most injuries in your unit. (You'll probably find the same ones that are discussed in this handbook.) Do this by answering the following questions.

- \* What kinds of accidents happen in your unit?
- \* How often do they happen?
- \* When do they happen?

Analyze the problems. Find the "why" behind the accident. For example, if a hatch cover crushes a soldier's fingers, it's not enough to just blame the accident on his failure to lock the hatch. You have to find out why he didn't lock it. Ask yourself the following.

- \* Was the injured soldier trained in all unit SOPs?
- \* Were SOPs routinely enforced?
- \* Had the soldier received unit training in the task he was performing when he was injured?
- \* Were all MWOs checked for compliance?
- \* Were safety - critical components inspected for proper maintenance?
- \* Were crewmembers briefed on special considerations such as terrain and weather?

Prevent the problems. Determine what you can do to prevent the problems. Here's a short list of ideas to get you started.

- \* Give additional crew training for adverse weather conditions or unusual terrain (ice, snow, fording, bridges).
- \* Develop emergency procedures for engine failure, fire, loss of steering, lateral and track failure. Conduct practice sessions until these procedures become routine.
- \* Develop safe unit procedures and conduct crew drills to practice the procedures.
- \* Require checks for proper equipment stowage prior to move-out.
- \* Cross-train crewmembers according to Soldier's Manuals and Job Books, not by the "buddy system."
- \* Train drivers to move safely in areas with little clearance.

Safe operations don't just happen. They result from careful planning. Develop your plan and put it to work. Then constantly analyze it. See how your crews respond to it. See if it reduces or gets rid of your safety problems. If it does, keep refining it to make it even more effective. If it doesn't, try a new plan. But in any case, remember your safety plan should not be just temporary. Write it down and distribute copies to your NCO leadership. Keep it working.

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## **Six things leaders can do to save lives and equipment**

1. **Set high standards.** Set and enforce high operating standards in every activity of your unit. Safety is a by-product of professionalism, of doing the job right the first time every time. By-the-book, disciplined operations are mandatory.

2. **Know your soldiers.** Know their training status and their qualifications. Test new people's knowledge, regardless of whether or not they have been previously operator certified. This applies to weapons, every type of moving equipment, even gas masks—all equipment.

3. **Know your equipment.** Know its capabilities and its condition. Numerous check sheets and publications are available to guide you.

4. **Apply dispatch discipline.** Many accidents involve equipment that should not even be out of the motor pool or off the helipad. Commit the use of equipment only when necessary, only when it can contribute to genuine training in the unit mission. Tough-minded dispatch discipline reduces exposure to accidents.

5. **Manage risks in training.** Integrate the requirement for safety with the demand for realistic combat training. A high degree of safety can be achieved through the systematic management of inherent mission risks.

6. **Maintain awareness.** Be constantly aware of the mission-critical importance of safety in all your operations. You cannot allow yourself to relax your vigil and become complacent when everything is running smoothly. Continuous awareness of the requirement for integrating safety into all day-to-day unit operations is essential to maintaining peak readiness.

# Risk Management

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Risk management is the process of making operations safer without compromising the mission. Accident experience shows that mission-stopper accidents occur when victims are ignorant of hazards and countermeasures or when directed countermeasures are ignored. The greatest effort should be in hazard identification and countermeasure enforcement. This section provides leaders guidance on integrating the risk management approach into unit operations.

## Rules

Three rules guide the risk management process:

**Accept no unnecessary risks.** The leader who has the authority to accept a risk has the responsibility to protect his soldiers from unnecessary risks. An unnecessary risk is one that, if eliminated, still allows mission accomplishment.

**Make risk decisions at the proper level.** Make risk decisions at a level consistent with the commander's guidance. The leader responsible for the mission should make the risk decisions.

**Accept risks if benefits outweigh the costs.** Leaders must take necessary risks to accomplish the mission. Leaders must understand that risk-taking requires a decision-making process that balances mission benefits with costs.

## Process

There are five steps to the risk management process:

**Identify risks.** During mission analysis, identify specific risks associated with all specified and implied tasks. Determine the hazards causing these risks. Consideration of METT-T factors helps identify risks and is crucial to the second step of assessing risks.

**Assess risks.** Determine the magnitude of risks. This involves an estimate of loss cost and probability. The METT-T format provides an excellent guideline of factors to consider in this risk assessment. The *Enemy* equates to specific hazards identified. Consider the following aspects of other elements: *Mission* complexity and difficulty; *Terrain*, all aspects of the physical environment, including weather and visibility; *Troops*, supervision, experience, training, morale, endurance, and equipment; *Time* available for execution, planning, and preparation. Determine the likelihood and extent of accidental loss based on the above analysis.

**Make decisions and develop controls.** Make risk acceptance decisions by balancing risk benefits against risk assessments, and eliminate unnecessary risks. Reduce the magnitude of mission-essential risks through the application of controls. Controls range from hazard awareness to development of detailed operational procedures. Be sure controls **do not** jeopardize mission accomplishment. Involve the chain of command if necessary risks or controls prevent assigned mission requirements.

**Implement controls.** Integrate specific controls into plans, orders, SOPs, training performance standards, and rehearsals. Knowledge of controls down to the individual soldier is essential.

**Supervise.** Enforce controls and standards. This is key. Evaluate mission progress and changes to METT-T, then begin appropriate corrective actions. After mission completion, evaluate risk decisions and controls for inclusion in lessons learned.

## Integration techniques

Two techniques are critical to maintaining unit battle focus:

**Individual/leader risk management** (focuses on individual through company-level command thought processes to recognize hazards and take action to reduce risk). Use FM 22-100: Military Leadership problem solving, decision making, and planning process. Identify the problem (hazard), gather information, develop courses of action, analyze and compare actions, make a decision, make a plan, and implement the plan. Memory aids such as METT-T and checklists help promote consistency.

**Command echelons risk management.** This technique uses the FM 101-5: Staff Organization and Operations Manual military

decision-making process. This process integrates safety and risk assessment into operational decisions normally associated with battalion and higher planning and operations. The commander directs the staff to identify necessary risks and risk controls as "considerations affecting the possible courses of action." Staff officers use memory aids such as METT-T to promote consistency. The final commander's estimate and concept addresses significant risk acceptance, eliminations, and controls. Implement these decisions directly into applicable areas of OPLANS (ORDERS). Commanders must ensure dissemination and enforcement of risk decisions and controls down to soldier level.

## COUNTERMEASURE OPTIONS

The countermeasure option checklist below has direct application to the development of risk-reduction options. You can use it to develop a full array of possibilities and then weed out those that are clearly impractical. The product of the risk-reduction phase should be a list of options that are practical, although not necessarily desirable, for the particular operation.

1. Eliminate the hazard: Eliminate the hazard totally, if possible, or substitute a less hazardous alternative.

2. Control the hazard: Reduce the magnitude of the hazard or provide containment or barriers.

3. Change operational procedures: Modify operational procedures to minimize risk exposure consistent with mission needs.

4. Educate: Train personnel in hazard recognition and avoidance.

5. Motivate: Motivate personnel to use effective hazard avoidance actions.

A key factor in detecting significant risk is to maintain a strong organization mission perspective. Adapt these basic assessment elements to fit your organizational needs. You can also develop additional matrix charts that blend in special considerations. One caution - keep the process simple. The idea is to develop a quick measure for risk and then determine an array of options for eliminating or controlling that risk.

Risk reduction measures are an important factor in the details of tactical procedures and will be a meaningful part of written and verbal orders. Similarly, safety checks, special training, briefings, revisions to SOPs, etc., are all accomplished as an integrated part of the operational process.

What's the payoff? The risk management approach gives leaders a tool to improve efficiency, effectiveness, and safety in all operations. The payoff is in increased readiness as a result of safer, smarter, more beneficial training.

Risk management permits the execution of realistic training scenarios not possible without risk management procedures due to their high potential cost in accidents. It also minimizes personnel and materiel losses in day-to-day training activities. Finally, leaders who routinely use risk management techniques to make risk decisions in training are prepared to make better risk decisions in wartime, resulting in better tactical decisions, and thus greater mission potential.

In summary, the effective leader defines his objectives and standards of performance for each operation he conducts. These objectives and standards include risk management factors as the full equal of the tactical, logistical, and leadership components.

### **Three Tier Approach to Safety**

#### **Command Level (Unit safety responsibility)**

- Plans for safety
- Validates the structural soundness of training (level of proficiency and logical/progressive sequencing)

#### **Leader Level (OIC/COIC Business)**

- Ensures adherence to standards
- Alert to changes in situation
- Executes accident prevention measures

#### **Individual Level (Everyone's Business)**

- Attitude and awareness

**The Commander is ultimately responsible for unit safety. He must validate the structural soundness of training. Training that exceeds the level of proficiency of soldiers involved must never be conducted (this goes back to our earlier discussion of risk and training proficiency). Training must be conducted in a logically progressive sequence (a unit should never conduct a live fire mission without first proving proficiency in blank/dryfire). In the schoolhouse this task is accomplished in the training development/planning phase.**

**Leaders at training sites are responsible for the safe execution of training. They enforce standards and accident prevention measures and are always alert to changes in training conditions.**

**Finally, everyone should make safety a *way of life*. We need to instill safety awareness in our soldiers, watch out for our "Buddies," and step in when an unsafe act or condition exists (leaders/trainers must instill a sense of initiative and candor).**

# **Human Error Accidents**

Human error is the single largest cause of Army accidents. If there is to be a major reduction in Army accidents, there must be a major reduction in the human errors that cause these accidents.

Accident experience shows that human-error accidents are frequently clear indicators of training weaknesses--the same training weaknesses that would quickly deplete a unit's capability to fight in combat. The root cause of the problem is failure to train to standard or to the right standard. The solution lies in integrating safety into our training and operational processes.

In simple terms, the human-error accident is an accident caused by an individual's error in required performance. Required performance is that which normally can be expected as a result of school or on-the-job training, commonly accepted practices, or SOPs, regulations, technical manuals, or other guides.

There are four major reasons for HUMAN ERROR.

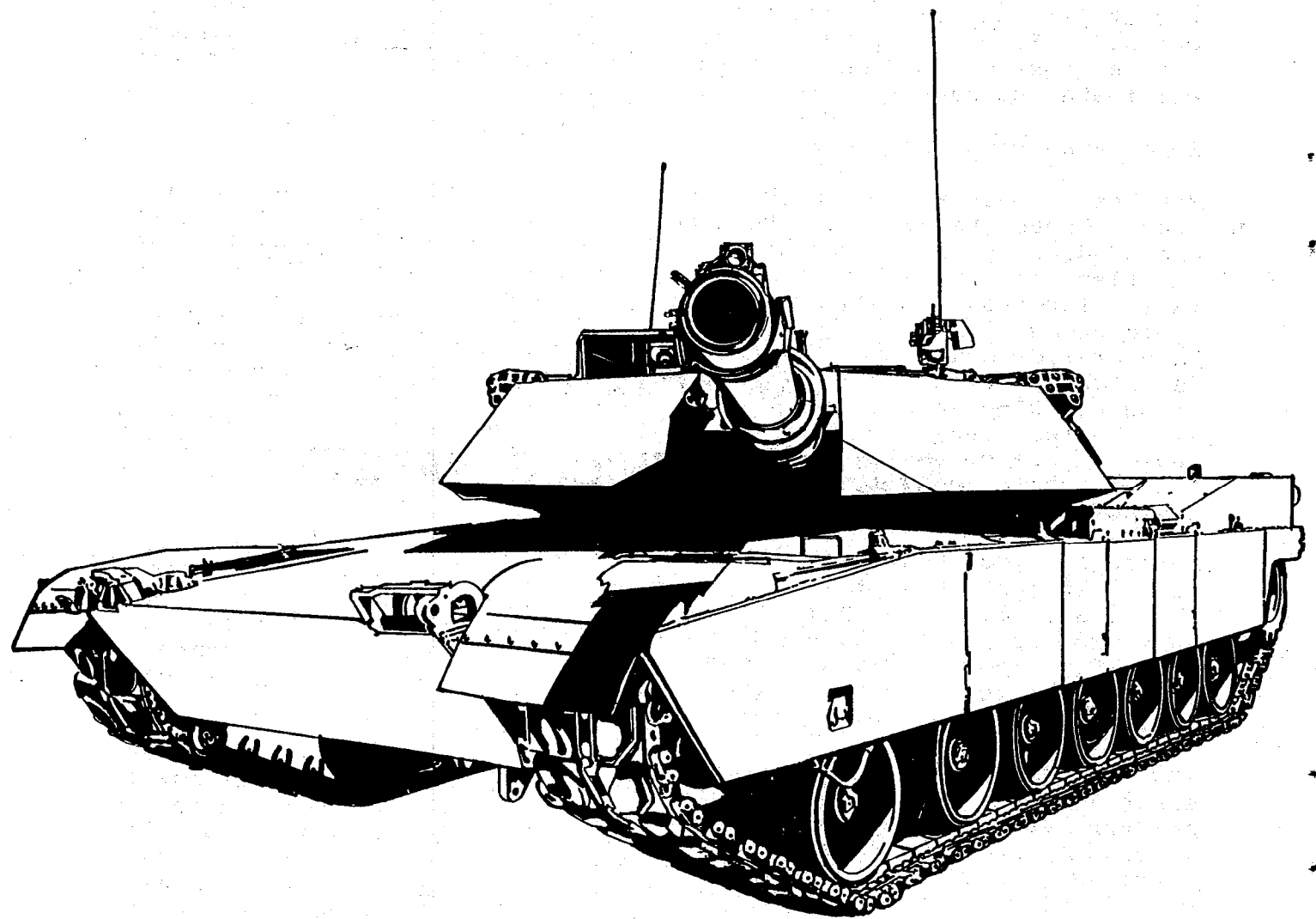
<b>Major Reasons for Human Error</b>	
<b>Standards are not clear or practical or do not exist</b>	<b>Command Failure</b>
<b>Standards exist but are not known or ways to achieve them are not known</b>	<b>Training Failure</b>
<b>Standards are known but are not enforced</b>	<b>Leader Failure</b>
<b>Standards are known but are not followed</b>	<b>Individual Failure</b>

Unit leaders are in the best position to combat human error by making safety an integral part of operations. The best way to do this is to integrate safety into the process used to develop operational plans. This integration must begin the moment the mission is conceived and continue until the last lesson learned is written and acted upon. Safe performance is a predictable result of performing to standard, and performing to standard is a result of training to standard. Training to standard leads directly to discipline, and disciplined soldiers are inherently safe.

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# **CHAPTER 2**

## **TRACKED VEHICLE SAFETY**



## COMBAT TRACK VEHICLES

Accidents happen in and around Track Vehicles - the masters of the modern battlefield. Lives are lost, people are injured, and property is damaged. Experience shows that the same weaknesses in operations, training, maintenance, and attitudes that produce accidents during controlled training situations in peacetime, will result in a dramatic increase in accidents under the pressures of combat. From the viewpoints of current economy, morale, readiness, and a possible combat situation tomorrow, now is the time to eliminate the causes of Track Vehicle accidents.

### Some causes and remedies:

**Hatches** - Just about everybody would describe a hatch as a "solid" item. Those who have had the hatch slam shut on their fingers agree one-hundred percent on that point. Each year Army personnel incur injuries as a result of improperly secured hatches or hatches with faulty latches slamming shut on fingers, necks, backs, or heads. Avoid those injuries. Make sure hatch latches are working properly. Have crewmen double check a hatch each time it is open to be sure it is latched! Finally, during the occasional cross-country dash, have personnel keep an eye on the latches or hatches. A big enough jolt will defeat any latch. Don't be in the way when that happens. Never operate the hatch while moving except during an emergency. The hatch is too large and heavy to operate while the soldier is trying to maintain his balance.

**Unsecured Equipment** - Track vehicles are designed to operate off roads in just about any reasonable terrain. When a vehicle leaves the road, it can be pretty rough going for the crew inside. The same is true of the equipment and supplies stowed inside the vehicle. Many accidents occur because equipment is unsecured. Ammunition comes out of racks, machine-guns fall off mounts, and improperly stored items become flying objects.

The old standby - good housekeeping - is the key here. Combat Track Vehicles tend to accumulate a lot of odds and ends and small maintenance needs are often overlooked - an ammo box stuffed here, a bracket bent there, a faulty latch, and a loose mount are all examples. Most of these never cause any problems until the day the vehicle hits a ditch or bump that couldn't be seen because of smoke, terrain, or light conditions. Then the bracket breaks, the latch pops loose, the mount falls and the air is full of everything from main gun rounds to gum wrappers. Prevention demands good solid housekeeping, the kind that pays attention to detail. At the end of the day, the job isn't done until after the vehicle is reasonably clean inside. This action is a good point to add to after operation checklists, if it isn't already there. Finally, steady insistence day in and out that there is a place for everything will invariably result in a safer, more combat ready crew.

**Fire accidents - Fuel is the major source of Track Vehicle fires. The typical fire involves a faulty connection or break in the fuel line with the fuel reaching an ignition source within the engine compartment.**

After the fire suppression system knocks the fire down, often more fuel sprays on the hot engine and ignites again. Keep the engine compartment as clean as possible to prevent the buildup of dust, and dirt soaked with flammable oils and greases. Ensure the integrity of the fuel system, especially following maintenance that involves pulling the pack. Ensure that fire protection systems are fully charged. The average vehicle fire costs the Army \$90,000. Prevent them!

**Maintenance Accidents - Combat Track Vehicles are massive pieces of machinery. Even most of the components of a tank are massive. When two of these pieces come together with a human between them, the result is almost always severe injury. Most Track Vehicle maintenance injuries occur while individuals work around roadwheels and the tracks. These components of the suspension system are heavy, hard to reach, and often under tension; and the accident potential is high. Track and suspension system maintenance is a team or crew effort. This work should be done following the TM. Where the TM doesn't provide the guidance needed, the more detailed unit SOP should be followed. Repetitive maintenance tasks should be done "by the numbers" under experienced supervision. Maintenance tasks are inherently "dangerous" and deserve the same attention to detail normally reserved for explosives and weapons systems.**

## M1 TANKS

The Abrams tank is one of the most technologically advanced Main Battle Tanks in the world. It travels at speeds which are unmatched, fires with pinpoint accuracy, and provides the Armor soldier with a very survivable combat system for all battlefield environments. This tank, however, can be very unforgiving to the soldier who tries to take shortcuts or does not follow procedures. Soldiers must be made aware of the extreme importance of all safety warnings in manuals and on the vehicle. Leaders must set the example of safe operations and stress safe training and safety awareness. Close supervision is extremely important for all personnel working in, on, and around the tank. Soldiers must become very familiar with their crew positions, related hazards, and responsibilities. The M1 tank is not a perfect tank, but it may be one of the safest tanks the Army has ever fielded. Still, there are some safety facts that users need to know. The information which follows highlights the top five injury causing accidents related to Abrams vehicle operations. It is important to note, that all these accidents are preventable.

**Turret movement injuries** - A very serious hazard which can be completely eliminated occurs when the loader's foot protrudes through the loader's swing toe guard opening and is crushed when the turret is traversed. A metal guard is available which completely covers the opening in the loader's swing toe guard. You must ensure that your tank has these metal guards and that they are always in place while the tank is in operation. Furthermore, the loader or any crewmember should never prop their feet up on the turret ring or protective screens. These type of injuries can be completely eliminated by enforcing standards. Ensure that protective screens are in place and not damaged, stress crew communications between crewmen before movements. Crew drill is the answer - No power or traversing anytime without the standard alerting commands. Crewmen must protect themselves!

**Ammunition door injuries** - Personnel performing duties near the semi-ready and ready ammunition doors must be extremely cautious of what they are doing. A significant number of serious injuries have resulted in amputations and crush injuries to soldiers' hands and fingers. These accidents are usually caused by someone accidentally activating the ready ammunition door knee switch. All soldiers must be cautious anytime they are near the ammunition doors. They must always perform their duties as stated in the appropriate TM. The number and severity of ammunition door accidents can be reduced by close supervision and strict adherence to warning and procedural guidance. Anytime maintenance is being performed on the ammo doors, the circuit breaker should be turned off, and careful attention must be given to body placement and movements. Many ammunition door injuries have occurred while two soldiers are in the turret and one inadvertently activates the knee switch without the other soldier's knowledge. Communication and coordination between soldiers is essential.

Slips, trips, and falls - They still happen, even with the newest and best tanks. This category of accidents continues to be the most frequently reported personal injury accident. Because of the Abram's speed, area of operations, and heavy design, soldiers receive numerous bumps, cuts, and other injuries. Often times the tank is operating in very rough, unfamiliar terrain, and thus crewmen are easily tossed about the vehicle. The soldier is usually thrown from his crew station, or thrown forward into machine-gun mounts or hatch rims, resulting in severe injuries to the head, face, arms or legs. Soldiers must be in constant communications to warn each other of abrupt stops or approaching road hazards. Related to falls within the vehicle, are the falls off the outside of the vehicle while mounting, dismounting, or walking on the tank deck. These accidents usually occur because of slippery walking surfaces or carrying equipment while walking on the tank. Soldiers must heed the warning which states that three point contact with the vehicle is always a must.

Abrams vehicle fires - The majority of Abrams fires occur on the older tanks. Analysis shows almost 70 percent of these fires result from poor maintenance techniques which damage or loosen critical hardware. Changes are being reviewed and made to many procedures, manuals, and hardware systems to provide units with current Abrams fire prevention information and equipment. The key to minimizing fire damage to the vehicle is to have personnel trained and prepared in responding to the fire. This can be accomplished by stressing that crews practice fire drills. There is much information available to units on fire prevention and on identifying fire hazards before one occurs. The areas which are considered very critical are listed below.

1. Battery Box and Electric Quick Disconnects
2. Hydraulic Quick Disconnects
3. Power Turbine Stator (PTS), Hydro-Mechanical Unit (HMU), and Smoke Generator Lines and Fittings

You must make sure that the hardware and manuals which your units are using are current and identical to those being used in other Armor units.

Cannon - Inside an M1 tank the cannon is king. Nobody can win an argument with it. The cannon catches the careless in three ways: it recoils into them, traverses or depresses the breech down on them, or catches fingers or hands in the breach. Accordingly, everybody in the crew must learn to live with it. This is done in two ways. The first is through individual training; i.e., each person knows where to stand or not to stand, how to load and not to load. The second is through crew coordination as established and practiced through crew drill. Training to established safety standards can and should be a part of crew drill.

## M60A1 and M60A3 Tanks

M60A1 and M60A3 tanks are heavily armored combat vehicles. They are operated by 4-man crews consisting of tank commander, gunner, loader, and driver. These tanks provide a stable gunfiring platform for long-range and accurate first-round-hit capability that is maintained with tank and enemy targets in motion during day and night operations. The following is a discussion of the most frequent accident causes and accident prevention countermeasures.

Vehicle handling/clearance  
Maintenance/material failure  
Mounting and dismounting/exterior movement  
Interior movement/improper positioning

### Vehicle handling/clearance

Although vehicle handling is a common cause factor in both M60A1 and M60A3 accidents, it is reported more frequently for the M60A3. Drivers often do not follow proper procedures when operating these vehicles. Many accidents result from excessive speed for conditions. To prevent this type of accident, drivers must adjust their speed for the existing weather and road or terrain conditions. When parking on hills, slopes, or inclines, the driver should fully engage the parking brake and chock the vehicle before leaving it unattended.

Failure to judge clearance is another cause of accidents. Drivers try to negotiate tanks around other vehicles and obstacles without using ground guides. Drivers should never back these vehicles without using proper ground guiding procedures. Good judgment is a must when driving tanks through narrow spaces and when passing moving vehicles. Drivers must remember to check turret placement to ensure gun tube clearance. Drivers should never try to pass when they are unsure about the clearance.

Rough terrain requires slower speeds. Crewmembers are suffering serious injuries from being bounced and banged around the interior of the tank. When approaching rough terrain, drivers should alert crewmembers so they can brace themselves. Poor or limited visibility is another problem. Dust, bad weather, and poor illumination are all factors contributing to this problem. Drivers should use extreme caution and wear safety goggles during daylight operations and use night vision devices during night operations.

### Maintenance/material failure

Brakes and other worn parts such as hatch locking pins and grille door handles are a major cause of these accidents. It is important that all preventive maintenance checks and services are done properly and on time. Maintenance personnel are being seriously injured because they are not following proper procedures. They are not using the proper technical manuals and tools, are not wearing appropriate personal protective equipment, and are not getting assistance when moving heavy objects.

## Mounting and dismounting/exterior movement

Soldiers need to maintain three points of contact when mounting, dismounting, or moving around on the exterior of the vehicle. Too many soldiers are still injuring themselves jumping from tanks instead of properly climbing down using the three-point-contact method. They should mount and dismount the vehicle from the left or right front. Adding sand in the paint on these areas will provide better traction. Soldiers should use extra caution when the surface of the tank or the soles of their boots are wet, muddy or dusty. Ice and other residue should be cleaned off the tank and soles of boots before mounting, dismounting, or moving about. Soldiers should always wait until the vehicle comes to a complete stop before mounting or dismounting.

## Interior movement/improper positioning

Slips and falls are as common inside as outside the tank. The same precautions are required - clean, cleared work surfaces and clean dry boot soles. Serious injuries occur when soldiers' bodies get in the way of the turret traversing system or the stabilization system (M60A3). These systems cause the gun breech to elevate and depress continuously when in operation. Crewmembers must give each other warning calls before activating any system. They should let each other know where they are and which system is being activated. Because of noise inside the tank, this countermeasure will be useless unless all crewmembers wear operational CVC helmets at all times.

## Summary

M60A1 and M60A3 tank accidents can be minimized if the following actions become routine:

- \* Wear and use operational CVC helmets.
- \* Maintain proper positions while executing tasks.
- \* Warn crewmembers of upcoming rough terrain.

These actions should be emphasized in all training programs. Improper attention is a common factor in all of the injury causes discussed. The area inside the tank is small, there is a lot of equipment, and many activities are going on. Because of this dangerous environment, it is imperative that all crewmembers be attentive to the task at hand and know what's going on around them. Training and safety policies and procedures are written for a reason, and they should be followed. Remember, a successfully accomplished mission is a safety-integrated mission.

## SAFETY PROFILE, M-551, SHERIDAN

After Vietnam the Sheridan was replaced by the M60A1 and later by the M60A3. The top four major accident cause factors for the Sheridan reported to USASC have been:

1. Speed
2. Ground Guides
3. Driver Training
4. Lack of Attention to Procedure (Safety)

Interestingly enough, these factors not only apply to the M-551, but to all combat vehicles in general.

### SPEED

Speed alone generally does not cause accidents. Excessive speed and either poor road conditions or driver inexperience do. We, as soldiers, need to realize that speed is a dangerous element which must be controlled. We all like to drive fast, and sometimes the mission may require us to drive faster than normal. Use reasonable, common sense. Better to be late and alive, than dead and never arrive!

### GROUND GUIDE PROCEDURES

During the last few years, the Safety Center had recorded one fatal accident and several injuries due to the failure of crewmembers to comply with "Ground Guide Procedures" outlined in FM 21-308. The Golden Rule of ground guides should be, "Never stand between two vehicles when ground guiding". Standing between two vehicles, no matter if they are tracked vehicles or not, is a sure invitation to get killed. Always use two ground guides (one front and one rear) when moving a vehicle in a restricted or built up area (track park) and in tactical areas where troops are on the ground.

### DRIVERS TRAINING

Another factor that adds to the accident rate is nonlicensed personnel trying to do more than they are either capable of or authorized to do. If you move the vehicle you need a license! Additionally, new inexperienced drivers tend to try things with which they are unfamiliar or for which they have received no training. As an example, inexperienced drivers generally have not acquired the skills necessary to drive in a confined or restricted area. It requires complex physical and mental training to complete such task. NCO/Supervisor: Do not require new drivers to accomplish tasks for which they are not trained!!! Just because a soldier has a license doesn't mean he can drive in all situations. Be Aware!

## LACK OF ATTENTION TO SAFETY PROCEDURES

Safety professionals, year after year, have written letters, conducted safety meetings, and personally conducted safety inspections in order to accomplish the mission safely and with minimum injuries to personnel and damage to equipment. Yet, year after year safety precautions are not observed. Many times we get away with a safety short cut, but, every now and then, our shortcuts catch up with us. When we continually ignore Safety Procedures, we will eventually pay the price!

For example, while in a hasty defense position, the Sheridan crew was engaged in attacking vehicles with the main gun simulator. After the loader had inserted a fresh cartridge, he informed the gunner that the system was ready to be fired. The loader had not pulled his hand and arm from behind the simulator after giving the gunner the "up" and was burned on the right arm when the simulator fired. Again, he knew better! Safety procedures are provided for a purpose. Learn them, then use them.

## BRADLEY FIGHTING VEHICLE

The Bradley Fighting Vehicle (BFV) is designed in two configurations: M-2 Infantry Fighting Vehicle with a crew of nine and the M-3 Cavalry Fighting Vehicle with a crew of five. Both vehicles are fully tracked and lightly armored, possessing shoot-on-the-move capabilities for engaging the full spectrum of enemy targets. They have swim capability and can perform both infantry and cavalry missions.

This profile focuses on the most common type accidents involving the BFV and corrective actions that can prevent them.

Vehicle movement  
Mounting/dismounting/external movement  
Maintenance  
Weapon system  
Turret movement

### Vehicle Movement

- \* Use BFV seatbelts and required head protection to help prevent injury when negotiating rough terrain or during a rollover sequence.
- \* Drivers should maintain safe speed and alert passengers to rough terrain when driving cross-country.
- \* Passengers should use available handholds for bracing.
- \* Assure sufficient clearance, especially if turret is traversed. The protruding machinegun barrel extends beyond the hull and can be damaged by trees or other objects.
- \* Make sure safety pins are installed in hatch latches before movement.
- \* Use ground guide when moving the BFV where people are dismounted, day or night. Use a ground guide anytime vision is obstructed.
- \* Don't turn sharply at high speeds.
- \* Have TC and gunner serve as additional eyes for the driver, especially during right-hand movements because of limited visibility to the right.

### Mounting/Dismounting/External Movement

- \* Use three points of contact when mounting, dismounting, or moving on top of the vehicle. Do not jump from the vehicle!
- \* Use extra care if mud, water, or spilled fuel is on boots or vehicle surface.

### Maintenance

- \* Perform routine after-operation maintenance checks and services such as checking transmission oil level carefully. But remember that the transmission and other engine parts are hot after operation.
- \* Perform maintenance by the book: obey all cautions and warnings.

- \* Install anti-recoil plug on fire extinguisher bottle discharge port to prevent accidental discharge when bottle is unsecured.
- \* Lift only the power unit with the engine and powerpack lift sling. Lifting both power unit and stand will exceed design limits.

#### Weapon System

- \* When clearing or repairing weapon systems, shut down turret. Check operator or maintenance manual for necessary equipment conditions.
- \* Secure spring in equilibrator assembly in the compressed position during maintenance.

#### Turret Movement

- \* Do not enter or exit turret while turret power is on. Keep turret shield door closed and latched while turret power is on.
- \* Don't stow equipment in the ramp hydraulic unit, because damage to it could cause a "free fall" ramp.

## M88/M88A1 Medium Recovery Vehicle (MRV)

The full tracked medium recovery vehicle, M88/M88A1, is an armored full track-laying, low silhouette vehicle. It is used for hoisting, winching, and towing operations for tanks and other vehicles. It is equipped to assist in repairing disabled vehicles under general field conditions. The vehicle carries a crew of four.

### Accident prevention actions

- \* Use three points of contact and available handholds for proper mounting, dismounting, and external movement on the MRV.
- \* Use proper maintenance procedures. Critical tasks include track maintenance and lifting activities.
- \* Use two or more people to install/remove the tow bar.
- \* Coordination and teamwork are necessary to prevent mashed hands, fingers, and feet as well as back strain.
- \* Inspect connectors such as eyebolts, towing pintles, and dead-man cable connectors to ensure serviceability and appropriateness for load.
- \* Keep hands and fingers away from pinch points and cables.
- \* Tow at safe speeds, especially on corners and inclines.
- \* Prevent engine fires by ensuring no engine leaks and that wiring harnesses are properly maintained and insulated.
- \* Tow the M1 using operational limits imposed by TMs. Do not ride on or in M1 while towed. Use third vehicle as a holdback vehicle. Tow speed is not to exceed 5 mph with tow bar or 2 mph with tow cables.

### Operation cautions

Do not use the 25-ton snatch block if cap screw is not installed. If there is no hole in the hinge for the screw, immediately notify organizational maintenance for installation. Failure to secure clevis to hinge with the cap screw could result in the release of the snatch block during lift operations, causing fatal injury.

Damaged or kinked shifting linkages can cause the vehicle to remain in forward gear after the shifting lever has been placed in the reverse position. Do not use any linkage as a step or place any weighted objects on the linkage. A transmission shifting linkage alignment check shall be performed anytime the vehicle's powerplant is removed/installed.

Excessive speed while towing on inclines can cause enough momentum in the towed vehicle to cause the MRV to become difficult to control. MRVs have overturned as a result. The TM states that maximum speed on hilly terrain is 2.5 mph or the lower speed specified in the TM. Crews should not be exposed to more than name tag defilade and should be prepared to drop into the vehicle to avoid injury if the vehicle overturns.

Do not raise the hoisting boom by external mechanical means. This action creates a void in the hydraulic fluid on the downward side of the boom hoist cylinders, allowing the boom to fall freely.

#### **Top Six M88/M88A1 Accident Activities**

- 1. Performing maintenance**
- 2. Mounting/dismounting/moving on top of vehicle**
- 3. Hoisting and slinging operations**
- 4. Towing accidents**
- 5. Installing/disengaging towbar**
- 6. Fires**

## M113 ARMORED PERSONNEL CARRIER

The M113A1/A2 is a fully tracked, lightly armored personnel carrier (APC) designed to carry 12 troops and the driver. It is a multipurpose vehicle that is used to transport cargo, carry troops, or conduct reconnaissance missions. In addition, it can be equipped to carry a hospital litter or a capstan kit and can be used as an ambulance. This article focuses on the most common causes of accidents involving the APC and corrective actions that can decrease or prevent recurrence. The most common classification of accidents reported were:

- Rough terrain
- Limited visibility
- Premature hatch closure
- Inattention
- Maintenance/material failure
- Mounting and dismounting
- Slips and falls
- Rollovers

### Rough Terrain

Because the APC can travel easily over rough terrain, drivers often operate their vehicles at speeds too fast for terrain conditions. Personnel and equipment are thrown around inside the vehicles, and are thrown against gun mounts, cupolas, and hatches. Operators can prevent these accidents by:

- \* Operating the M113 at speeds safe for terrain and condition.
- \* Ensuring equipment is secured inside the vehicle.
- \* Ensuring all personnel are wearing seatbelts before vehicles are put into operation.

### Limited Visibility

Total blackout conditions, dust and fog contribute to APC accidents. These conditions cause operators to lose sight of approaching vehicles or the one they are following. Other reported cases involve vehicles driving off roads or bridges. These accidents include head-on and rear-end collisions, and vehicles overturning and running into trees. These accidents can be decreased or prevented by drivers:

- \* Adjusting speed to conditions and maintaining proper intervals between vehicles.
- \* Using ground guides when traveling cross-country during periods of reduced visibility and when operating in areas where troops are on the ground (assembly, cantonment, bivouac areas, etc.).
- \* Halting vehicle if vision is obscured.
- \* Always remaining alert for dangers that could result in injuries to the crew or damage to the vehicle.

## Premature Hatch Closure

Hatches continue to close on soldier's heads, hands, and arms. These accidents occur because either the hatch exterior locking bracket is not installed or the locking pin is missing, not installed, or unserviceable. Operators can prevent these accidents by:

- \* Not operating vehicles until all hatches are secured.
- \* Inspecting locking pins for serviceability and replacing unserviceable pins.
- \* Securing hatches in the open position with either rope, straps, or chain if the bracket or locking pin is unserviceable or missing.

## Inattention

Another common incident involves soldiers not paying attention to what they are doing or what other soldiers or crewmembers around them are doing. These accidents result in fingers, hands, arms and feet getting closed in hatches and doors. Other reported cases involve soldiers working in or around engine compartments. They get fingers and hands caught in fans, and clothing caught between belts and pulleys, or burn themselves on hot engine parts. Soldiers can prevent these accidents by:

- \* Being more observant and keeping all parts of the body away from hatch and door openings.
- \* Warning others before closing hatches or doors and ensuring they are clear before closing.
- \* Stopping the engine before working on or near fans or belts, ensuring good communications between mechanics and helpers, and ensuring no one can start the vehicle while it is being worked on (disconnect battery cable or attach a highly visible warning tag in driver's compartment).
- \* Using extreme caution when working in or around the engine compartment or hot engine parts. If time permits, wait for the engine to cool or take precautions such as long sleeves or gloves.

## Maintenance/Material failure

Accidents reported involving either maintenance or material failure were:

- \* Final drive breaking, causing loss of control.
- \* Prop shaft to steering control differential breaking, causing loss of control.
- \* Broken or thrown tracks.
- \* Sprocket bolts shearing off.
- \* Inoperative laterals.
- \* Differential overheating or locking up.
- \* Defective governors, causing engine to exceed braking capacity

Supervisors/operators can prevent these accidents by:

- \* Ensuring proper before, during, and after-operation PMCS are performed IAW the -10 TMs.
- \* Being safety conscious and anticipating possible equipment malfunctions.
- \* Not using the brakes if the vehicle throws a track while in operation. Let off accelerator and allow the vehicle to coast to a stop.

#### Mounting and Dismounting

M113 APC accidents continue to happen when soldiers mount or dismount. Soldiers dismount by jumping from vehicles and injuring legs, ankles, and knees. There are cases where soldiers attempt to mount moving vehicles and get their feet caught between the drive sprocket and track. These accidents can be prevented if soldiers are more safety conscious and:

- \* Maintain three points of contact with the vehicle.
- \* Never mount or dismount a moving vehicle.
- \* Never dismount by jumping.
- \* Follow SOPs and use steps or prepared areas (roughly textured for traction) where available.

#### Slips and Falls

Soldiers working on top of vehicles slip and fall due to wet, oily, or icy surfaces. Soldiers can prevent or decrease these accidents by:

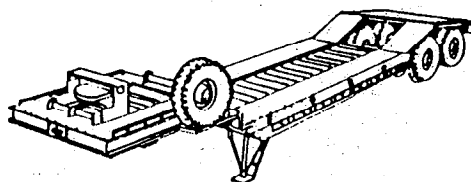
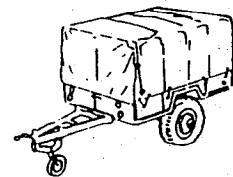
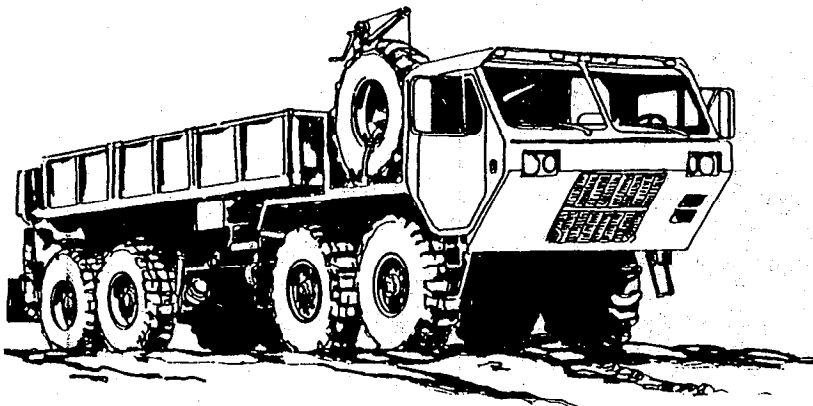
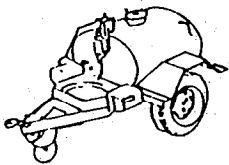
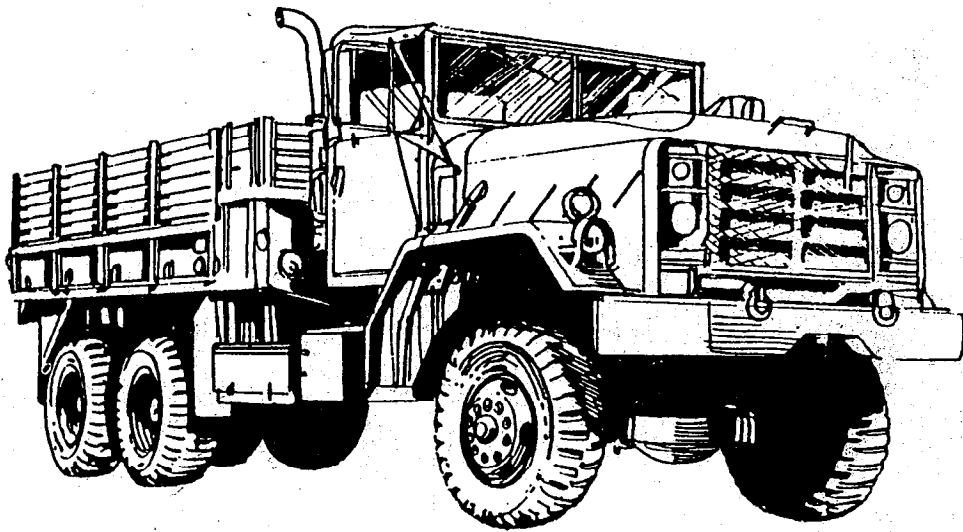
- \* Always using the three-points-of-contact rule.
- \* Removing ice and snow from vehicles.
- \* Cleaning oil spills off vehicles.
- \* Using sand on paint or other roughly textured materials to improve traction on highly traveled areas.

#### Rollovers

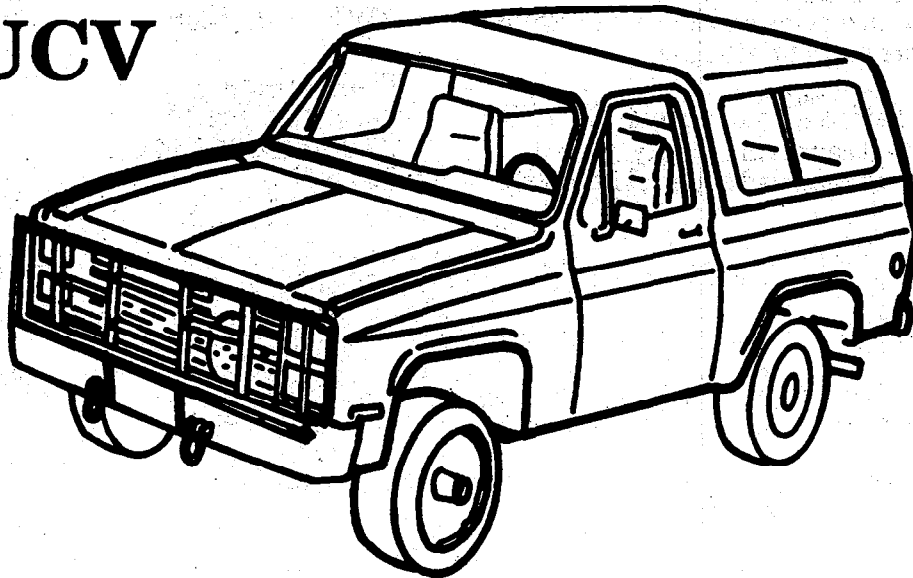
In a recent 5 year accident study of rollovers, there were over 105 recordable events with 35 fatalities, 96 lost workday injuries, and over \$7,300,000 in damage. The causes of rollover accidents are many and varied, but the crew's emergency actions should, in most cases, be the same. Make sure your tracked vehicle crew(s) know that it is safer to remain inside the vehicle. Crewmembers who try to jump clear of a rolling vehicle are often crushed by that vehicle. Emergency actions for a rollover should not only be included in crew SOPs, but also practiced by all crewmembers during drills. Make sure your soldiers know the emergency actions to take in case of loss of control, and vehicle overturn. Stress that crewmembers must immediately get down into the vehicle if it becomes evident that it is going to rollover. Let them know that it's better to risk a few bruises or breaks, than to risk being crushed by an overturning vehicle. Remember, the safest place in a rollover is inside!

# **CHAPTER 3**

## **WHEELED VEHICLE SAFETY**



# CUCV



The M1031 series commercial utility cargo vehicles (CUCVs) are  $\frac{3}{4}$ - and 1-ton tactical trucks. The utility version looks like the commercial Blazer. Because CUCVs make up almost half of the light vehicle fleet and get heavy use, they are involved in more accidents than most other tactical vehicles. However, because they are equipped with both lap and shoulder belts, injuries in CUCV accidents are relatively few and minor.

## Excessive speed

The speed limit in effect on a particular road or range is a maximum. Drivers should reduce speed—

- In off-road operations.
- On unpaved or rough roads.
- On winding roads.
- When approaching curves and corners.
- After dark, especially while using night vision devices.
- In rain, snow, sleet, dust, or fog and when the road is slick.
- When traffic is heavy.

Any time driving conditions are not ideal.

## Failure to follow procedures/inadequate training

Many times failure to follow procedures is related to insufficient training; drivers don't follow the procedures because they don't know the procedures. In other cases, drivers don't follow procedures because the requirement is not enforced. For example, disregard of the requirement to wear safety belts is one failure to follow procedures that calls for strong command action.

This category also includes trying to make the vehicle do things it's not designed for, in disregard of the operators manual. Accident

## Leading accident causes:

- Excessive speed
- Failure to follow procedures/inadequate training
- Inattention
- Materiel failure/inadequate PMCS

records show that some drivers have assumed the CUCV could go up hills and down dips at will, that it could maneuver just like the jeep. It can't.

Tactical vehicles require special driver training. The fact that a driver is licensed to drive commercial vehicles does not mean he'll be able to handle all the situations and conditions he may encounter off the public roads.

## Inattention

This cause factor is common for vehicle accidents in general. Operating a vehicle requires the driver's full attention. Drivers

must learn to discipline themselves to concentrate on driving and leave everything else to a more appropriate time.

### **Materiel failure/inadequate PMCS**

These accident causes are closely related, since nearly all recorded materiel failures

could have been prevented by performing PMCS by the book.

### **References**

TM 9-2320-289-10

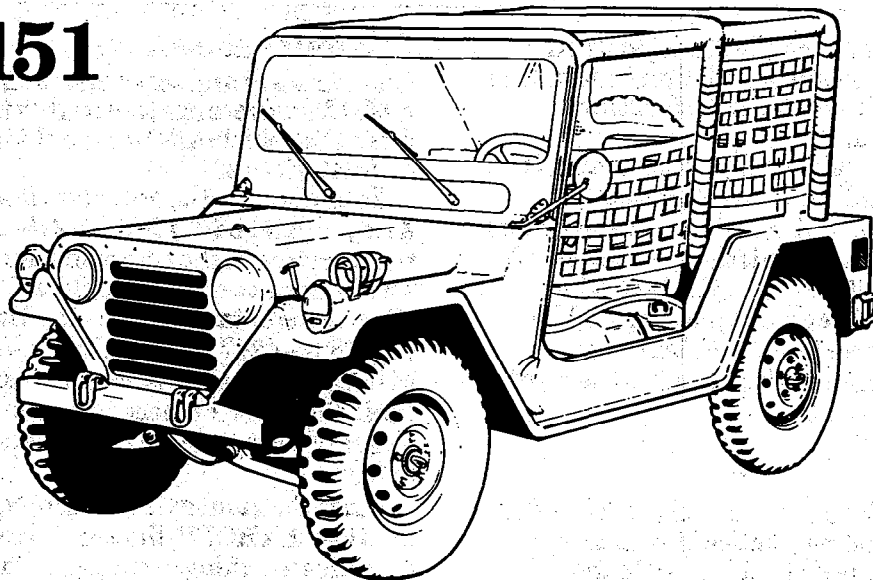
TB 9-2300-295-15/24

FC 55-32



## **Safety Belts Save Lives**

# M151



**For years the M151 1/4-ton truck was involved in more accidents, usually with fatalities and injuries, than any other tactical vehicle. Since the installation of a rollover protection system (ROPS) and personnel restraint systems, there has been a dramatic reduction in fatalities and injuries.**

## **Excessive speed**

Excessive speed is the most frequent contributing cause of M151 rollover accidents. Attempting a turn at a speed excessive for conditions too often results in another M151 rollover accident. Drivers must be warned again and again of these three factors—speed, turns, and rollovers.

The operators manual, TM 9-2320-218-10, warns: "... M151 series vehicles ... have more responsive steering and acceleration than other vehicles. Watch speed, especially on turns. A full right or left turn at speeds over 20 mph (32km/h) can cause any vehicle to go out of control and/or turn over."

An Army technical bulletin, TB 9-2320-218-10-1, puts the case even more forcefully: "All models of 1/4-ton trucks have a short wheel base and a high center of gravity for cross-country mobility. Operation of these vehicles at high speeds, combined with sharp turns, can result in rollovers. The M151 has independent wheel suspension and gives little warning to the driver by body tilt or 'feel' if he is turning too fast. With independent wheel suspension, the rear inner wheel has a tendency to lift from the road, and the rear end breaks away to the outside of the curve. To

## **Leading accident causes:**

- **Excessive speed**
- **Failure to follow procedures/inadequate training**
- **Inattention**
- **Failure to clear**

correct this condition, the driver must apply less steering turn and reduce speed."

The maximum operating speeds stated in the TM are only guides to the mechanical capacity of the vehicle in each gear ratio. Maximum safe speed is not determined by the figures on the data plate or on a chart in the TM. Road conditions, weather, visibility, and loading determine the speed at which an M151 should be driven.

## **Failure to follow procedures/inadequate training**

Many times failure to follow procedures is related to insufficient training; drivers don't follow the procedures because they don't know the procedures. In other cases, drivers don't follow procedures because the requirement is

not enforced. For example, disregard of the requirement to wear safety belts is one failure to follow procedures that calls for strong command action.

Each tactical vehicle requires training in its own unique handling characteristics. Especially important is training in emergency procedures—what to do if the vehicle gets off the roadway, or if another vehicle or other obstacle suddenly appears just ahead. The common panic reactions—to slam on the brakes or jerk the steering wheel to the right or left—cause accidents.

### **Inattention**

Operating the M151 requires the driver's full attention to anticipate turns in time to slow the vehicle to a speed that is safe for the conditions. Drivers must drive defensively and be constantly aware of changing road and traffic conditions.

### **Failure to clear**

This occurs when drivers are so intent on backing up, changing lanes, or making turns that they forget to ensure the way is clear of other vehicles, signs, or other obstacles before making their move. Backing an M151 does not ordinarily require a ground guide, but like turning and lane-changing, it does require a thorough scan in all directions, including the mirror and blind spot.

### **Operational cautions**

Commanders and supervisors should ensure all M151 drivers are thoroughly trained to drive the vehicle and are taught its characteristics.

In addition to the operators manual, the Army published TB 9-2320-218-10-1 to help train drivers in the safe operation of the M151. The TB lists two training films, TF 55-3707 (Operation of the M151 1/4-Ton Utility Truck) and TF 55-4247 (Truck, Utility, 1/4-Ton M151A2, Characteristics and Handling). Periodic review of these films can keep drivers aware of the special characteristics of the M151.

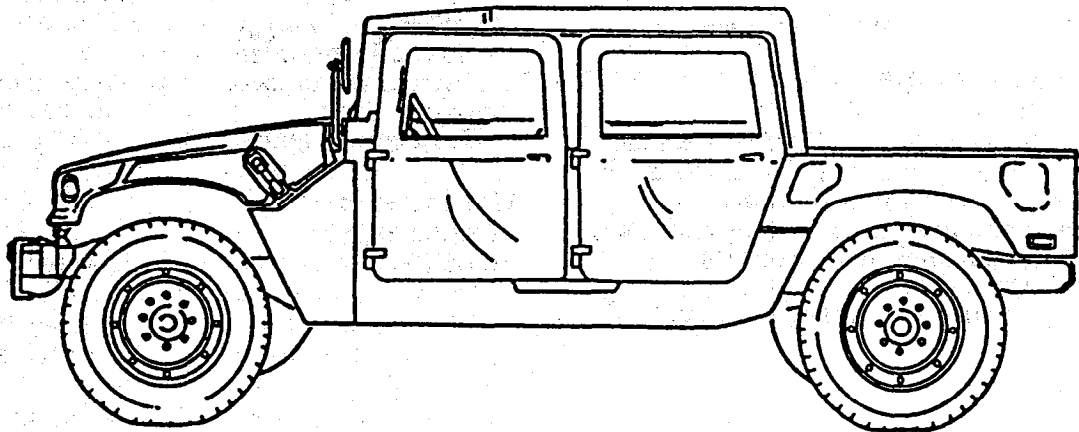
Since the giant safety step of equipping the M151 with a ROPS, the annual toll of rollover fatalities is a thing of the past. There have been several disabling injuries to personnel who failed to use safety belts (in violation of AR 385-55) and hit their heads on the rollbar. The first rollover fatality in a ROPS-equipped M151 was a passenger who slammed into the windshield because he had failed to buckle up.

### **References**

TM 9-2320-218-10  
TB 9-2320-218-10-1  
FC 55-32

## **Safety Belts Save Lives**

# HMMWV



The M998 series high mobility multipurpose wheeled vehicle was designed to meet light wheeled vehicle requirements of the battlefield of the 1980s and beyond. A 4x4 1-ton vehicle, the HMMWV consists of a common chassis that accepts various body configurations to accomplish combat, combat support, and combat service support roles.

## **Failure to follow procedures/inadequate training**

Many times failure to follow procedures is related to insufficient training; drivers don't follow the procedures because they don't know the procedures. In other cases, drivers don't follow procedures because the requirement is not enforced. For example, disregard of the requirement to wear safety belts is one failure to follow procedures that calls for strong command action.

Each tactical vehicle requires training in its own unique handling characteristics. Especially important is training in emergency procedures—what to do if the vehicle gets off the roadway, or if another vehicle or other obstacle suddenly appears just ahead. The common panic reactions—to slam on the brakes or jerk the steering wheel to the right or left—cause accidents.

The HMMWV's most troublesome feature is its width. Drivers must learn to make more allowance for obstacles or roadway edges on the right than with most other vehicles.

## **Excessive speed**

The speed limit in effect on a particular road or range is a maximum. Drivers should reduce speed—

## **Leading accident causes:**

- **Failure to follow procedures/inadequate training**
- **Excessive speed**
- **Failure to use ground guide/improper ground guiding**
- **Failure to compensate for restricted visibility**

- In open country.
- On unpaved rough roads.
- On winding roads.
- When approaching curves and corners.
- After dark, especially while using night vision devices.
- In rain, snow, sleet, dust, or fog and when the road is slick.
- When traffic is heavy.
- Any time driving conditions are not ideal.

## **Failure to use ground guide/improper ground guiding**

Ground guides are usually associated with larger trucks, but experience has shown that

when backing or maneuvering in a close space the HMMWV needs a ground guide too, because of its width and blind spots. A word of caution: The ground guide should never place himself between the vehicle and another object.

### **Failure to compensate for restricted visibility**

Accidents occur when the HMMWV collides with a stationary vehicle or flips into a ditch because the driver simply did not see it. Factors affecting visibility may be darkness, blackout drive, thick dust, precipitation, or a combination of these.

Any time a driver can't see a stopped tank

or a deep ravine, it is probable he can't see much of anything. When that's the case and the driver must keep moving anyway, he should drive as though surrounded by unseen obstacles and pitfalls, because he is. He should—

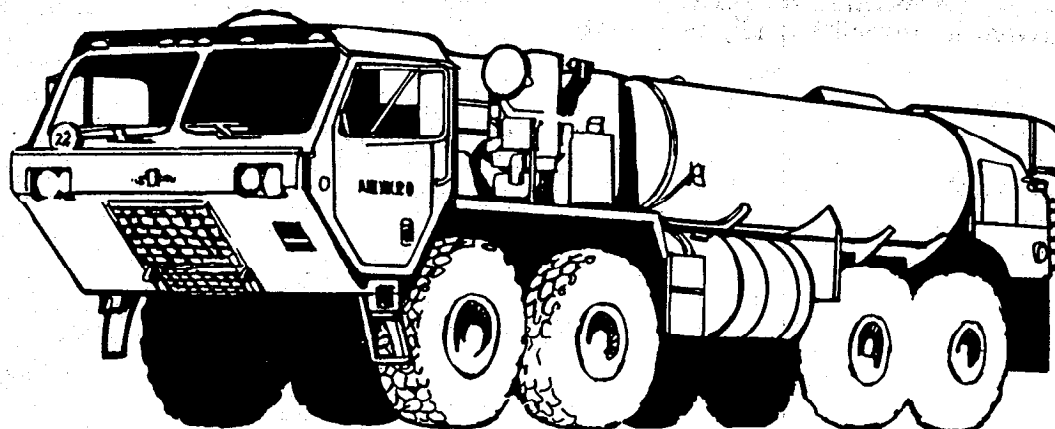
- Slow to 5 mph or less.
- Have all vehicle occupants help scan for hazards.
- Use a ground guide.

### **References**

TM 9-2320-280  
FC 55-32

## **Safety Belts Save Lives**

# HEMTT



The M977 series heavy expanded mobility tactical truck (HEMTT) is the new heavyweight on the block (62,000 to 95,000 pounds). It is used for direct rearming of the multiple launch rocket system, transport of Patriot erector/launchers, resupply of ammunition, and refueling of tracked and wheeled vehicles and aircraft in forward areas.

## **Failure to follow procedures/inadequate training**

Many times, failure to follow procedures is related to insufficient training; drivers don't follow the procedures because they don't know the procedures. In other cases, drivers don't follow procedures because the requirement is not enforced. For example, disregard of the requirement to wear safety belts is one failure to follow procedures that calls for strong command action.

Each tactical vehicle requires training in its own unique handling characteristics. Especially important is training in emergency procedures—what to do if the vehicle gets off the roadway, or if another vehicle or other obstacle suddenly appears just ahead. The common panic reactions—to slam on the brakes or jerk the steering wheel to the right or left—cause accidents.

It's especially important to keep the HEMTT on the roadway, whether paved or tank trail. More often than not, a soft shoulder will give way under the weight of a HEMTT and the vehicle will roll over.

## **Leading accident causes:**

- **Failure to follow procedures/inadequate training**
- **Excessive speed**
- **Inattention**
- **Failure to use ground guides**

## **Excessive speed**

When thinking of excessive speed, most people visualize a vehicle traveling at 60 to 70 mph. Not true. With the HEMTT, speeds of only 25 to 30 mph can be too fast depending on road conditions, weather, and the load carried.

## **Inattention**

Inadequate attention while following too closely is an accident waiting to happen, and a significant number of them do happen with HEMTTs—usually in convoys and involving two or more HEMTTs in a chain reaction.

Driving a HEMTT requires the driver's full attention. Drivers must discipline themselves

to concentrate on their driving and ignore potential distractions.

### **Failure to use ground guides**

A ground guide is a must any time the HEMTT is being backed or operated in a congested area. The vehicle is over 9 feet tall, measures 8

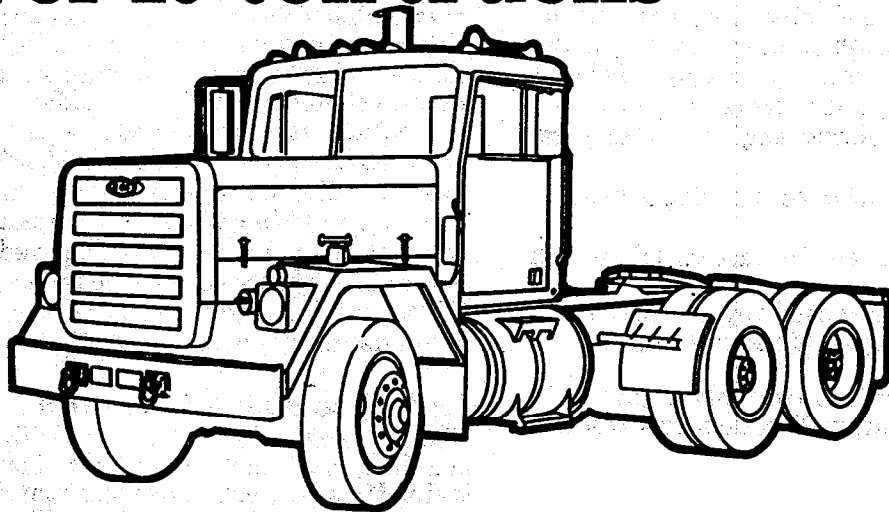
feet wide, and is 33.4 feet long. This is just too much vehicle for the driver to clear by himself.

### **References**

TM 9-2320-279-10  
FC 55-32

**Safety Belts Save Lives**

# Over 10-ton trucks



The M915 line haul tractor truck pulls the M872 and other compatible semitrailers. It has a maximum towed load of 86,000 pounds and limited cross-country capability.

## Inattention

Looking at the physical size of the tractor-trailer combination, it is obvious that the driving job requires the driver's full and full-time attention, and almost as much from the assistant driver. Once the driver loses control of this rig, it's unlikely he'll regain it. Long hauls should include arrangements for drivers to trade off so that driving stints coincide with a reasonable attention span and ability to concentrate.

## Failure to follow procedures

Two types of violations are frequent causes of M915 accidents:

- Failure to use a ground guide during backing, or improper ground guiding. A word of caution: The ground guide should never place himself between the guided vehicle and another object.

- Failure to follow guidelines in the operators manual (TM 9-2320-273-10) for use of the engine retarder when descending steep grades. Every M915 operator must be thoroughly familiar with the procedures, which follow:

### Proper downhill procedures

*Note:* Some of these actions may seem illogical or contrary to what your "common sense" would dictate, but *they are correct. Learn them thoroughly.* In an emergency situation, strict adherence to these procedures is essential.

## Leading accident causes:

- Inattention
- Failure to follow procedures
- Excessive speed
- Misjudged clearance
- Failure to maintain control

Select a gear that, with the engine retarder applied, will allow the engine to control truck speed with engine rpm at or below 2000 and service brakes not applied. In other words, as you approach a downhill grade, progressively select a gear that, when combined with the engine retarder, will allow you to maintain an engine speed of 1750 to 2000 rpm.

As engine speed exceeds 2000 rpm, use one positive application of the service brakes to slow engine speed to 1650 rpm, release the engine retarder, downshift one gear, and reapply the engine retarder. Repeat this procedure until engine speed can be maintained between 1750 and 2000 rpm.

*If the engine overspeeds* (above 2100 rpm), make one positive application of the service brakes to slow vehicle speed.

*If the transmission overspeeds* (above 2300

rpm) and totally disengages, perform the following:

- Release engine retarder.
- Upshift.
- Make one positive application of the service brakes to slow the vehicle and regain control.

*If the transmission totally disengages* due to shifting with the engine retarder applied and engine speed has returned to low idle freewheeling, accelerate engine to re-engage transmission.

*If total loss of braking occurs* due to heat buildup—

- Apply engine retarder (place switch in high mode).
- Upshift as engine speed approaches 2100 rpm. Before each upshift, release engine retarder.
- In 16th gear, continue to apply engine retarder and maintain directional control of the vehicle.
- Don't panic!

### Excessive speed

The tractor-trailer combination takes at least 72 feet to stop at 20 mph and twice as much at 30 mph. So drivers should leave plenty of room between them and the vehicle ahead. They should keep their speed moderate at all times to be prepared for sudden situations. In bad weather or traffic, they should reduce speed even more.

### Misjudged clearance

This problem shows up often in turning corners. The minimum turning diameters range from 53 feet for the M915 with M872 semitrailer to 90 feet for the M920 with M870 semitrailer, so it's very risky to assume clearance between the tractor-trailer and nearby vehicles or objects. When in doubt, drivers should use a ground guide.

Another often-misjudged clearance is between the top of the load and a bridge or overpass. The driver must know the height of the load, and when traveling an unfamiliar route, the driver needs to be prepared to detour in case a too-low bridge is encountered. Of course it is best to check out the route beforehand whenever possible.

### Failure to maintain control

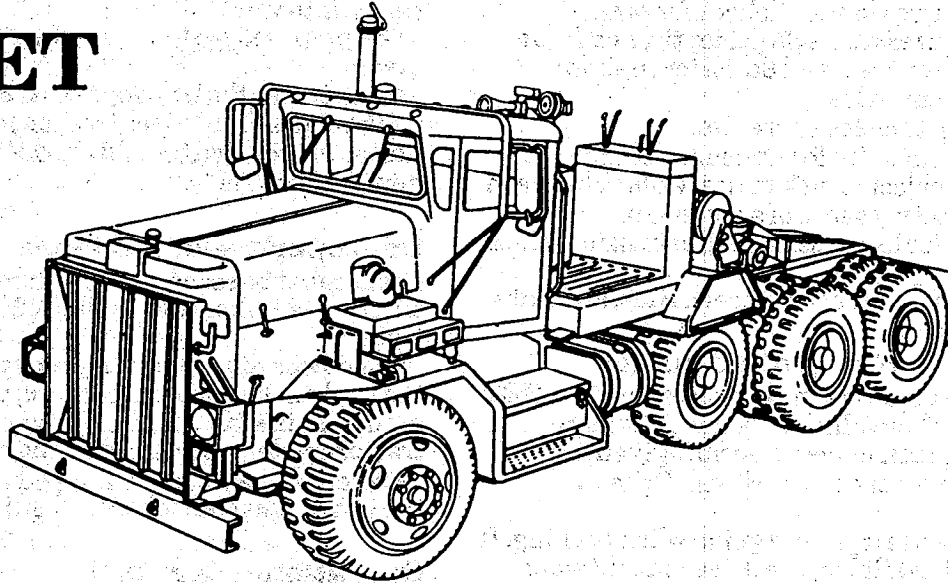
The best measure for prevention of these accidents is to ensure drivers are thoroughly trained in all aspects of handling the vehicle, including emergency procedures. They should refresh their memories by reviewing the operators manual periodically.

### References

TM 9-2320-273-10  
FC 55-32

## Safety Belts Save Lives

# HET



The M911 heavy equipment transporter pulls the M747 semitrailer with a 60-ton payload. Hauling tanks is the HET's prime mission.

## Failure to clear

The HET with the M747 trailer attached is around 67 feet long and almost 11 feet high. It takes up a lot of space on the road.

- Check height and width clearance of bridges and overpasses. An inch can make a big difference.
- Make sure clearance is adequate before changing lanes and passing other vehicles.
- The HET needs more turning space than most other vehicles. The turn radius of the HET is 43 to 47 feet.

## Following too closely/excessive speed

Tailgating with a HET is courting disaster. The HET weighs 39,952 pounds, and even at low speeds it takes some distance to stop. It takes even more with a loaded M747 trailer attached. For example, a HET with a 60-ton load going 20 mph needs about 80 feet to stop under ideal conditions.

- Keep a safe interval between the HET and the vehicle in front.
- Maintain safe vehicle speed.
- Remember that weight distribution affects stopping distance. Drivers must be aware that their cargo makes a difference.
- Use the hydraulic retarder to help slow the vehicle on downgrades or curves by releasing the accelerator and then depressing the retard pedal. You will get the best retarding effect in

## Leading accident causes:

- Failure to clear
- Following too closely/excessive speed
- Inadequate maintenance
- Inattention to ground guides
- Failure to obey traffic signals
- Improperly secured loads

the lower forward transmission gear ranges. Caution: Long continuous use of the hydraulic retarder will raise transmission oil temperature and may cause damage to the transmission. To prevent overheating, fully release pedal for short periods and reapply as necessary.

## Inadequate maintenance

There is no substitute for preventive maintenance checks and services (PMCS). Faulty brake systems and bad tires should be found during PMCS and corrective actions taken before the vehicle is driven. Drivers should also—

- Check for brake chatter, noise, and side pull.
- Check for proper operation of service and

parking brakes. If either is not operating properly, deadline the HET to ensure it's not driven until the problem has been corrected.

- While tires are cool, check for proper inflation pressure—95 psi for tires on front and pusher axles, and 85 psi for tires on tandem rear axles.
- Be sure to check spare tire.
- Check each tire for unusual wear or damage, objects stuck in tire walls or between treads, and presence of a valve cap.
- Check for loose, damaged, or missing wheel lug nuts.
- Check for damaged wheels, rims, and hubs.

### **Inattention to ground guides**

A ground guide is a must more often for a HET than for other vehicles because it is more difficult to maneuver. A seemingly slight judgment error can be critical. Drivers should —

- Always use a ground guide when backing. If one is not available, the driver should walk around the tractor and trailer to see where and how close obstacles are.
- Always pay close attention to ground guides, but especially when backing, turning, or trying to squeeze through one of those narrow little streets in Germany.
- Never move a HET until certain they understand the ground guide's instructions.
- Stop immediately if they lose sight of the ground guide.

### **Failure to obey traffic signals**

A surprising number of HET accidents have been caused by drivers failing to stop for a red

light. Since the HET has such a long stopping distance, drivers should—

- Start watching a traffic light as soon as it comes into view.
- Be prepared to stop even when the light is green.
- Remember that convoys must comply with traffic signals and other traffic control devices unless proper civil or military authorities direct otherwise.

### **Improperly secured loads**

Loads must be secured; they cannot be transported when simply parked on the trailer.

- Tiedowns must be strong enough to keep the load on the trailer in corners, up and down grades, or in a tilt position, as when the tractor/trailer wheels slip off the pavement.
- When the payload is equipped with a turret, the turret must be locked in position.

### **Operational cautions**

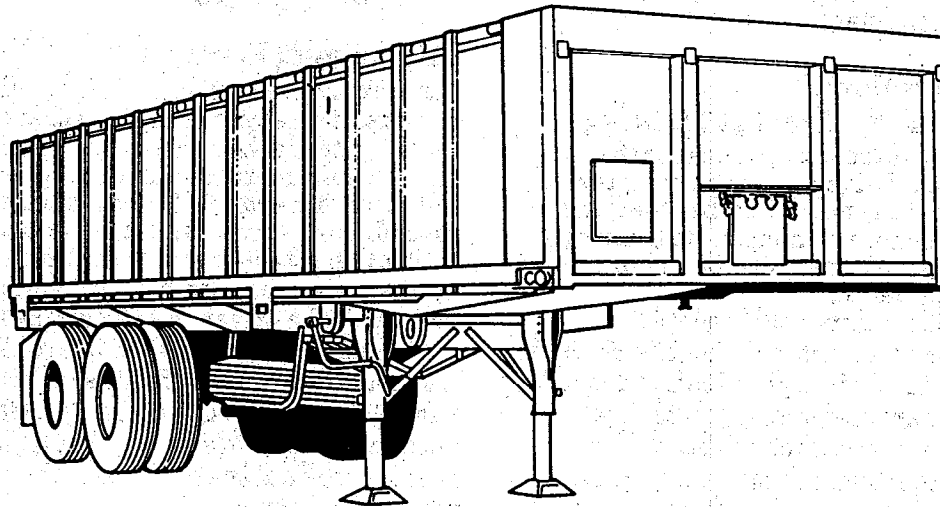
- Always wear safety belts.
- Don't permit anyone to stand directly behind the HET or trailer during coupling procedures.
- During winching operations, require everyone who isn't involved to stand clear of winches and payload.
- Personnel handling winch cables should wear heavy gloves and never allow the cable to run through their hands.

### **References**

TM 9-2320-270-10  
FC 55-32

## **Safety Belts Save Lives**

# Tactical trailers



The Army transportation system includes trailers from the  $\frac{1}{4}$ -ton M416 series to the 60-ton M747 low bed semitrailer. Their uses are as diverse as their sizes. And their use demands drivers with special skills because towing a trailer of any size adds all sorts of complexities to driving a vehicle.

## **Materiel failure/inadequate PMCS**

This type of problem appears to be more prevalent with trailers than with towing vehicles/prime movers. Even drivers who are conscientious about performing preventive maintenance checks and services (PMCS) on their vehicles sometimes forget that trailers require PMCS too.

Defects to be especially alert for (because they show up repeatedly as accident causes) are those involving—

- Wheels.
- Brakes.
- Brake lights.

## **Speed too fast for conditions**

This factor shows up often because one of the "conditions" calling for reduced speed is simply having a trailer in tow. Adding reduced visibility, rain, snow, or a road full of potholes makes for a situation needing greatly reduced speed.

Trailer accidents often occur on curves or at corners. If the driver doesn't slow way down, the trailer is likely to fishtail and overturn or hit another vehicle or object.

## **Hit from the rear**

This is a tough type of accident for the driver

## **Leading accident causes:**

- Materiel failure/inadequate PMCS
- Speed too fast for conditions
- Hits from the rear
- Failure to follow procedures/insufficient training
- Misjudged clearance

towing the trailer to prevent. But trailers (usually stopped) being struck from behind happens so often that towing drivers should remain alert to the possibility. They should ensure the trailer brake lights work and should try to increase the visibility of the trailers. When traveling in a convoy at night or any time visibility is reduced, vehicles, including trailers, will be marked at the rear with reflective tape or paint in accordance with AR 55-29. It would be advisable to mark trailers in this manner whenever they travel on public highways even if they're not in a convoy. During blackout drive operations, special caution is needed to prevent rear-end

accidents, both on and off the road. Lights and reflectors should be kept clean.

If drivers have to pull off the road, it should be well off the road, and warning flags or reflectors put in place.

### **Failure to follow procedures/insufficient training**

These factors are combined because they are closely related. Drivers may not know correct procedures or may not remember them in an emergency because of inadequate training, unfamiliarity with the operators manual, or simply inexperience.

Training is required for personnel to be licensed to drive a tractor-trailer combination. But the need for training is often overlooked when drivers are assigned to tow tactical trailers. It is a mistake for drivers or their supervisors to assume that driving a truck with a trailer in tow is the same as driving a truck without. It isn't. With a trailer hitched on, it is necessary to drive slower, turn and back differently, and drive even more

defensively, especially in relation to trailing vehicles.

In short, tactical trailer towing requires training.

### **Misjudged clearance**

This problem shows up often in turning corners. It's risky to assume clearance when pulling a trailer because turning is simply going to take more room than it does with just the truck or tractor. Slow *way* down and, when in doubt, use a ground guide.

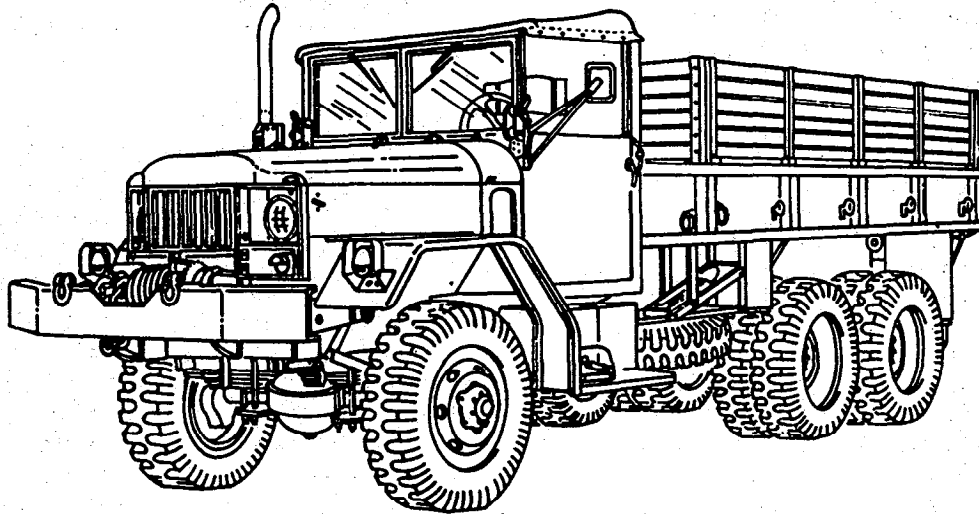
Another often-misjudged clearance is between a semitrailer and a bridge or overpass. The driver must know the height of his trailer or load, and when it is to be transported over an unfamiliar route, he needs to be prepared to detour in case he encounters a too-low bridge. Of course, it is best to check out the route beforehand whenever possible.

### **References**

TM 9-2330-series  
AR 55-29

**Safety Belts Save Lives**

# 2<sup>1</sup>/<sub>2</sub>- and 5-ton trucks



The versatile M44 series, M809, and M939 series trucks are designed to haul or tow almost anything the Army has that can be moved. They also have been used as a weapons platform to provide convoy security in combat.

## **Failure to follow procedures**

One failure to follow procedures that calls for strong command action is disregard of the requirement to wear safety belts. Drivers backing 2<sup>1</sup>/<sub>2</sub>- and 5-ton trucks without the aid of a ground guide is another. These vehicles are big, and the driver's rearward visibility is limited; a ground guide is essential for all safe backing operations. A word of caution: The ground guide should never place himself between the backing vehicle and another object.

## **Inadequate PMCS**

Before operating any vehicle, drivers must inspect it to ensure that it is mechanically safe to drive. Each year 2<sup>1</sup>/<sub>2</sub>- and 5-ton trucks are involved in approximately 100 accidents from loss of brakes. Most of these could have been prevented by proper PMCS.

## **Failure to maintain control**

The driver must be alert to the driving task. When pulling a trailer or transporting heavy cargo, drivers must avoid abrupt maneuvers and never jerk the steering wheel. All turns must be smooth and precise.

## **Leading accident causes:**

- **Failure to follow procedures**
- **Inadequate PMCS**
- **Failure to maintain control**
- **Environmental/road conditions**

## **Environmental/road conditions**

Easy-does-it is the rule when driving in rain, snow, or mud. These conditions require slower speed because of reduced visibility and increased stopping distances. Tank trails present the additional hazard of shoulder edges that can give way under the weight of the vehicle.

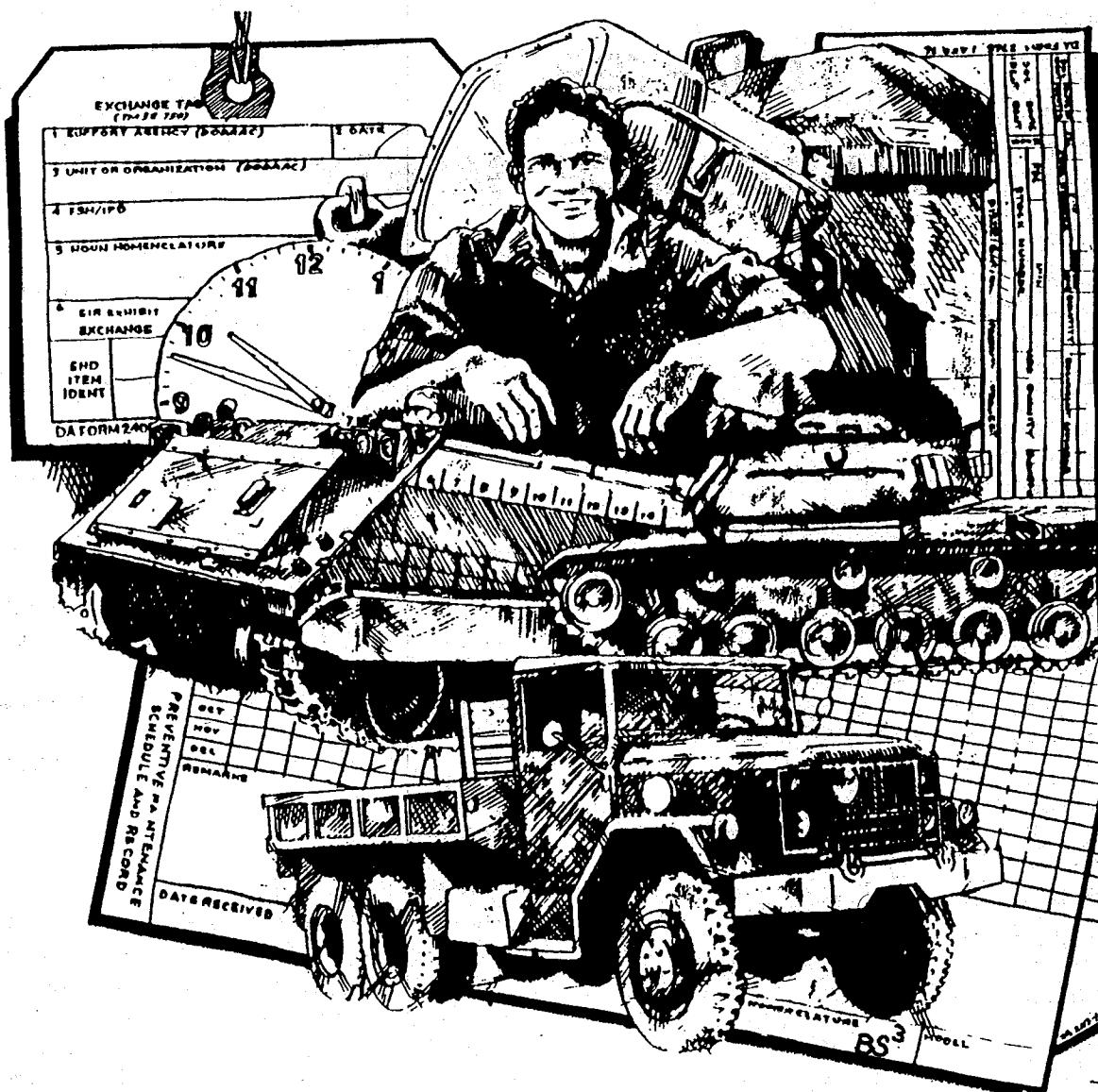
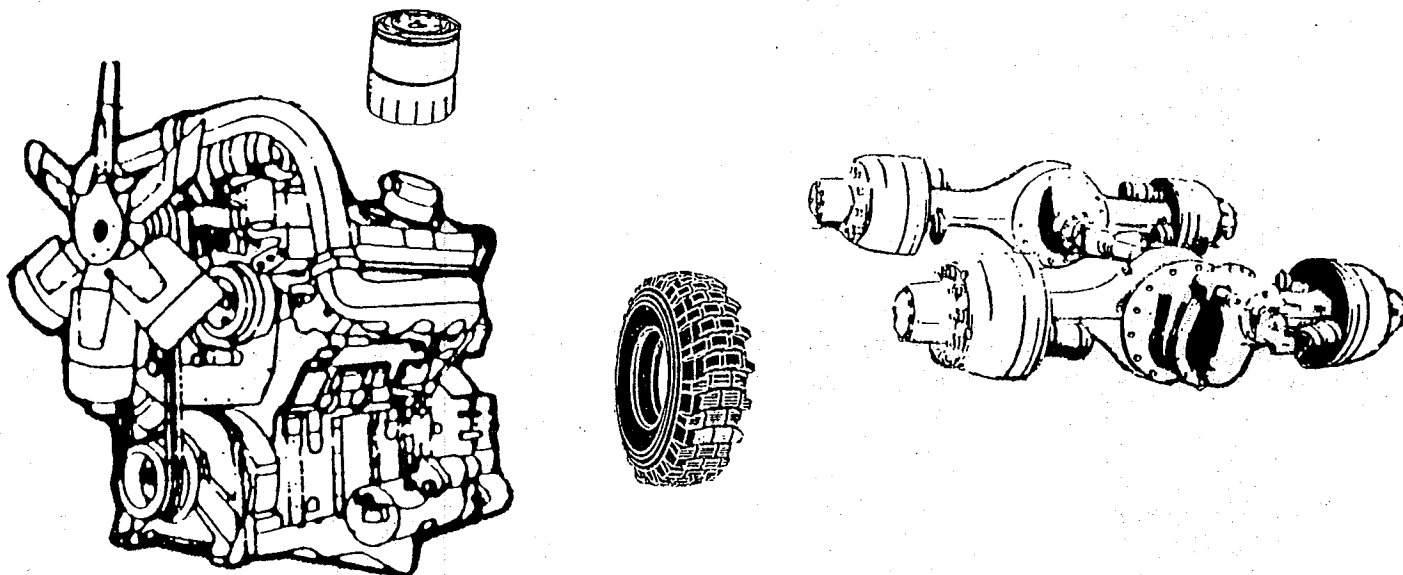
## **References**

TM 9-2320-209  
TM 9-2320-211  
TM 9-2320-260  
TM 9-2320-272  
FC 55-32

# **Safety Belts Save Lives**

# **CHAPTER 4**

## **MAINTENANCE SAFETY**



# Maintenance Accident Causes

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## **Most maintenance accidents are caused by:**

- Failure to follow procedures.
- Poor supervision.
- Lack of written procedures.
- Insufficient or no training for the jobs assigned.

### **Failure to follow procedures**

Shortcutting or disregarding established work procedures is the most frequent cause of accidents during installation, removal, and modification jobs. Mechanics may knowingly fail to use correct procedures because they are in a hurry to get the job done, because they do not understand the reasons for the work rules and the potential for injury, or because of a lack of supervision.

Using the wrong tools—lengths of pipe as extensions to increase leverage, screwdrivers as chisels, or hammers that are too heavy—is a common cause of maintenance accidents.

It's not enough to just write manuals and SOPs. They must be enforced. A "just get the job done and fast" attitude leads to taking shortcuts and accidents, injuries, and damaged equipment. It also produces a job that is neither "done" nor "fast." Many accidents happen when mechanics perform routine jobs that seem too simple to bother with safety precautions.

#### **Actions to take:**

Require strict compliance with safe work procedures no matter how routine the task.

Make sure all maintenance is done by the book.

Allow no shortcuts and watch for unsafe acts and violations of procedures.

Take prompt disciplinary action to correct violators.

### **Poor supervision**

Frequently, supervisors do not fulfill their

responsibilities. They permit the use of unsafe or incorrect procedures, allow shortcuts, or fail to closely monitor personnel. Poor supervision is the result of command failure to take positive action when supervision breaks down.

All the written procedures in TMs and unit SOPs won't prevent a single accident unless the procedures are practiced. And they won't be practiced unless supervisors insist on it.

Never forget that supervisors must also be supervised.

#### **Actions to take:**

Hold supervisors accountable for their own unsafe actions as well as those of their subordinates.

Ensure personnel are properly trained, then demand they do the job right.

Require supervisors to—

—Set a good example of professionalism, competence, and safety discipline.

—Insist on compliance with established work procedures no matter how routine the job.

—Require the use of the right tool for every job.

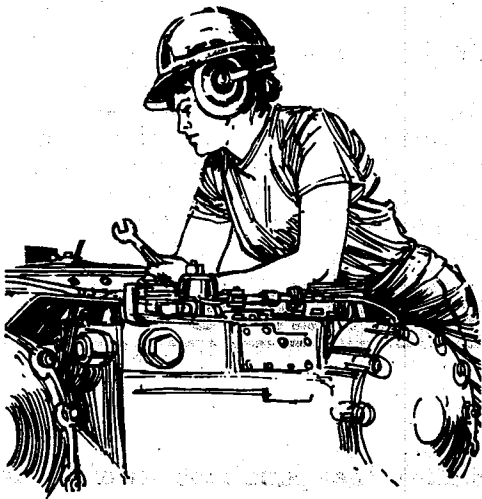
—Make sure protective equipment is available and worn.

—Use only qualified personnel for maintenance jobs.

—Set realistic time goals. Place more emphasis on safe, correct performance than on meeting work deadlines.

### **Lack of written procedures**

Insufficient written procedures show up in poorly written standing operating procedures and in vehicle technical manuals. This lack consists mainly of absent or incomplete procedures for certain maintenance tasks. SOPs are not periodically reviewed to keep them current. Failure to submit DA Form 2028: Recommended Chan-



ges to Publications and Blank Forms permits deficiencies in technical manuals to go uncorrected.

Voids in written procedures in manuals can be remedied using DA Form 2028 to submit changes to publications. This is necessary if procedural steps are omitted.

**Actions to take:**

Ensure all personnel know how to complete DA Form 2028.

Supplement TM guidance with unit SOPs.

Use safety information in DA Pam 750-35 as sample for unit maintenance SOP.

Include requirements for personal protective equipment in SOPs.

Review SOPs regularly to ensure they contain specific guidance about the unit's maintenance tasks and ensure SOPs are updated periodically.

Pay special attention to use of tools and equipment, communication, lifting, security and inspection of components, hazardous actions, depressurizing, and housekeeping.

Spend time training and helping mechanics who may not have the experience or expertise to perform jobs safely without guidance.

Use the safety checklist available from the local safety office or the maintenance safety

checklist in DA Pam 385-1.

**Insufficient or no unit training**

Mechanics are often assigned jobs for which they either are not trained or have received insufficient training. This occurs when supervisors do not correctly assess training needs and develop and conduct training programs. Insufficient command emphasis on training increases this problem.

**Actions to take:**

Assess unit training needs.

Develop appropriate training programs.

Conduct these programs.

Hold refresher classes to update and strengthen training on maintenance tasks.

Conduct training on unit SOP requirements.

Have manuals and needed equipment and tools available.

Keep training performance oriented.

Make sure all supervisors and trainers take seriously their responsibility for teaching soldiers correct procedures and safe practices by setting the right example and consistently demonstrating professional standards of conduct.

## **Study of Maintenance Accidents in Wheeled and Tracked Vehicle Facilities**

The U.S. Army Safety Center recently analyzed selected Army maintenance accidents that occurred in wheeled and tracked vehicle facilities. These selected maintenance accidents involved on-duty soldiers and civilians injured while installing, removing, or modifying equipment in these facilities. The study of these accidents identifies 11 problem areas which account for the majority of the accidents. It also reveals that four primary cause factors are regenerating most of the accidents. In addition, the study shows that—

- Most of the injuries involve tactical Army motor vehicle maintenance. (There are more of these vehicles in the Army inventory than other types.)
- The user or organizational level of maintenance has the most injuries. (This is the level at which most maintenance manhours are expended.)

### **Problem areas**

**1. Improper use of tools and equipment.** Included in this area are the following specific items:

- Improper use of jacks, hoists, and lifts causes loads to shift and fall. Maintenance personnel are not using the correct jack, hoist, or lift, are not load-testing devices that require it before use, and they are not properly inspecting load security before and during operation.

- Protective equipment—safety goggles, gloves, shoes, and helmets—can do its job only if it is used. Too often protective equipment is not worn because the maintenance person is in a hurry, doesn't see the need to wear it, or doesn't know it should be worn. Supervisors often do not ensure the equipment is available, or they knowingly allow maintenance personnel to perform tasks without wearing it.

- Hammers are improperly used so that the head does not strike the intended target; hammers are used instead of the proper tool; or the wrong type hammer is used. Poor hammer strikes cause back strain, lacerations, contusions, and hand or head fractures. Using the wrong hammer for a job can cause it to bounce off the equipment and cause injury.

- Pliers used as clamps allow the load to fall and crush a finger. Personnel use standard pliers for tasks that require brake-spring pliers, and the pliers slip or the brake spring recoils, causing injury.

- Personnel use the wrong size or type of wrench or socket for their task. Even when they have the correct wrench or socket, they use it incorrectly (e.g., tool is not properly seated or fitted; rusted or tightly torqued nuts or bolts are loosened incorrectly; unauthorized extensions are added to handles for additional leverage). Using the wrong wrench or socket or using it incorrectly can result in it slipping or breaking, causing injuries. Overexertion can also result in and cause strained torso muscles.

- Screwdrivers are used as levers. Metal chips and particles break off and hit the user in the eye.

**2. Improper lifting.** Personnel lift repair parts, wheel assemblies, or other materiel incorrectly or fail to use appropriate assistance to do the task. Overexertion results in back, arm, and abdominal injuries. Shifting or falling parts and components cause face, hand, and leg injuries.

These two problem areas make up 61 percent of the maintenance accidents.

**3. Improper body position.** Personnel put themselves in hazardous positions or assume a body position that causes injury. Unstable and hazardous body positions result in falls, back and limb injuries, fractures, and burns.

**4. Inadequate security of components or equipment.** Personnel do not secure or do not properly secure components, equipment, or vehicles before moving them. Injuries to back and extremities result when these items shift.

**5. Improper pulling, gripping, or holding equipment or components.** Personnel pull too hard on tools or parts, do not grasp parts firmly, attempt to hold slippery components, etc. Muscle strains and falls are the primary injuries in this problem area.

**6. Inadequate inspection.** Personnel fail to verify that parts are in proper location and to detect jagged edges, defective parts, need for special lubrication, and dangerous work surfaces. Inadequate inspection of components, equipment, or work areas leads to hand injuries, burns, bruises, and falls.

**7. Inadequate communication.** Personnel fail to warn co-workers when they start a vehicle or move/operate equipment, and they fail to tell others of inoperable components or equipment.

**8. Failure to depressurize or disconnect components or equipment.** Maintenance personnel do not release pressure on hydraulic fluid, or they do not disconnect battery terminals before removing the battery.

**9. Inadequate improvising.** Personnel use their hands or feet instead of mechanical assistance.

**10. Obstructed/cluttered work areas.** Personnel do not clear the work area before beginning work, or they lay components or tools down during a maintenance task and then stumble into or over them.

**11. Materiel failures.** When written procedures are inadequate for tool use or materiel is inadequately manufactured, materiel failure occurs.

### **Cause factors**

**1. Inadequate self-discipline** is the most frequent cause of accidents during installation, removal, and modification tasks. Overconfidence, inattention, and haste are often involved. Personnel may knowingly fail to use proper procedures because they do not understand the reasons for the rules and the potential for injury or because of a lack of supervision.

**2. Inadequate supervision** results when leaders permit the use of unsafe or incorrect procedures or fail to closely monitor personnel. Insufficient command emphasis on safety permits supervisors to allow shortcuts. Supervisors are not monitored to ensure they fulfill their responsibilities. Also, corrective action is not taken by higher command when supervision breaks down.

**3. Inadequate written procedures** show up in the lack of standing operating procedures (SOP) and in vehicle technical manuals. Inadequacies consist mainly of absent or incomplete procedures for certain maintenance tasks. SOPs are not periodically reviewed to keep them current. Failure to submit DA Form 2028, Recommended Changes to Publications, permits deficiencies in vehicle technical manuals to remain.

**4. Inadequate unit training** results in personnel being assigned tasks for which they either are not trained or have received insufficient training. This occurs when supervisors do not properly assess training needs and develop and conduct training programs. Insufficient command emphasis on and monitoring of training furthers this problem.

### **Recommendations**

- Hold personnel accountable for safe conduct on the job.
- Include standards on safe performance in civilian employee performance appraisals for both employees and supervisors.
- Include evaluation of safe performance in Enlisted Evaluation Reports and Officer Efficiency Reports for subordinates and supervisors.
- Spell out in unit SOP requirements for use and type of personal protective equipment.
- Review all maintenance manuals to ensure guidance and instructions for tasks involving installation, removal, and modification of components are explicit and complete. Manuals should include tools for all tasks, designate necessary personal protective equipment, and include appropriate warnings or cautions. Submit DA Form 2028 to suggest improvements or to highlight deficiencies in manuals.
- Include in maintenance programs instruction in hand-tool safety, use of protective equipment, and proper lifting procedures.
- Ensure SOPs adequately describe methods to be followed and cover safety aspects of all activities.
- Ensure supervisors at all levels regularly conduct unscheduled spot checks to be sure

## Inspection and Testing of Lifting Devices

Inspection and testing of lifting devices (excluding jack stands and on-vehicle equipment) is governed by TB 43-0142: Safety Inspection and Testing of Lifting Devices. The major portion of this bulletin establishes inspection and testing procedures for implementation at installation level.

Inspecting, testing, and maintaining lifting devices are the installation commander's responsibility. However, it is the operator of such devices who ends up injured or held accountable for damage to equipment when a lifting device fails or malfunctions. To prevent injuries and equipment damage, testing and inspection procedures for lifting devices are outlined in the bulletin and are summarized as follows:

- **Load testing.** Accomplished before initial use of all new, extensively repaired, or altered lifting devices.

- **Daily inspection.** Performed by the operator before use.

- **Periodic inspection.** Conducted at least every 12 months by organizational maintenance personnel (may or may not include function test).

- **6-month inspection.** Completed before use of a lifting device that has been idle for 6 months or more.

Inspection criteria are outlined in TB 43-0142 for daily, periodic, and 6-month inspections.

It is also important to record these tests and inspections. Accordingly, the bulletin specifies documentation procedures that will be established for each lifting device. It also establishes a marking system for each device to indicate load capacity rating, date of next periodic inspection, and item identification number, if applicable.

Following are recommendations to assist users in establishing a program to ensure all lifting devices are operated and maintained in a safe manner.

- Appoint an individual who is knowledgeable in lifting-device operations as overall point of contact (POC) for testing and inspecting lifting devices.

- Have the POC coordinate with the equipment manager to ensure timely inspection and testing of lifting devices.

- Establish a training and qualification program for all operators.

- Maintain permanent records of inspections and load tests.

- Have all lifting devices marked, labeled, and tagged in accordance with TB 43-0142.

- Attach copies of daily inspection instructions on or near all lifting devices.

- For more complicated devices such as cranes and hoists, attach a copy of operating instructions in the vicinity of the operator control area.

- Address lifting-device safety at unit safety meetings on a recurring basis.

- Ensure that all authorized lifting devices and those required by vehicle maintenance manuals are available, serviceable, and used.

## Power Generator Grounding

The proper grounding of power generating equipment is a must for safe operation. If a short circuit occurs somewhere in the generator or in the distribution system, stray electrical current might cause injury or death to personnel and damage to equipment.

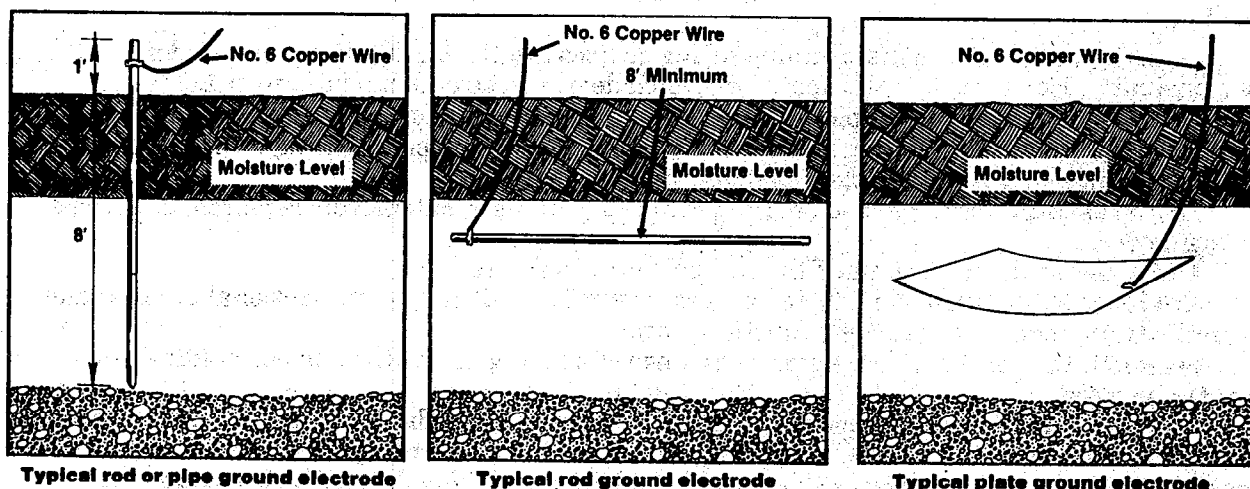
There are three basic ways to ground tactical portable power generation equipment.

- **Rod electrodes.** The standard ground rod used by the military is a  $\frac{5}{8}$ -inch copper rod with three 3-foot sections. The rod electrode must be driven at least 8 feet into the ground. If this can't be done, the electrode can be buried in a horizontal trench below the moisture level. In both situations, the rod must be at least 8 feet long (see illustration).

- **Pipe electrodes.** A clean metallic pipe of at least  $\frac{3}{4}$ -inch trade size can also be used, but it must be driven at least 4 feet into the ground. If this can't be done, an 8-foot pipe can be buried in a horizontal trench below the moisture level.

- **Plate electrodes.** A buried plate electrode also can be used. Plate electrodes should be not less than 10 inches wide and 10 inches long (100 square inches). If an iron or steel plate is used, it must be at least  $\frac{1}{4}$ -inch thick and of nonferrous metal at least .06-inch thick. Plates must be buried below the permanent moisture level (see illustration).

To ground connections, put one end of the ground cable (not less than No. 6 AWG) to the ground terminal of the set and tighten the nut securely as outlined for the generator in FM 20-31: Electric Power Generation in the Field. Connect the other end of the cable to the grounding electrode with the special grounding clamp specified in FM 20-31.



## Parking Brake

Repairers and operators should be aware that if they are doing maintenance in the cab of a 2 1/2-ton or 5-ton series truck they can easily disengage the parking brake if they accidentally bump the handle.

Soldiers should remember to put chock blocks under each side of the vehicle, below the intermediate wheels, to prevent the vehicle from rolling backwards or forward.

## Towing Safely With the M88A1

Cancellation of the Improved Recovery Vehicle program puts the burden of towing on the M88A1. Towing with the M88A1 and like vehicles will become riskier as ongoing fielding of the 65-ton M1A1 and future fielding of the 68-ton M1A1 (HV armor) puts heavier equipment in the field.

A review of M88A1 towing accidents showed that damage most often resulted when the towed tank pushed the M88A1 while descending a steep grade or when the M88A1 attempted to stop.

Countermeasures include the following—

- When towing an M1 Abrams, always use another M1 as a hold-back vehicle, even when using a tow bar.
- Never allow anyone to ride in or on an M1 while it is being towed.
- Always tow at 5 mph or slower when using a tow bar. Tow at 2 mph or slower when using a tow cable.
- Never make sharp turns in first gear. Make gradual wide turns.
- Never make sudden stops.
- Care must also be taken in other areas. Soldiers must be protected from the Abrams exhaust heat when hooking and unhooking towing devices from the towing vehicle. Special care should be taken to avoid skin contact with hot tow bars when unhooking.

In addition, when towing one M1/M1A1 with another, the angle formed from the tow pintle to the tank's upper lifting/towing eyes can "push" the tank doing the towing, especially when going downhill. The downward angle of the tow bar may also cause it to bottom out when cresting hills or traversing ditches.

Units still using the unimproved tow bar clevis should be aware of the high risk for tow separation due to tow bar failure. An improved clevis that is expected to remedy the problem has

been fielded. The improved clevis is NSN 5340-01-067-2908. Full-up tow bar, which includes the improved clevis, is NSN 2540-01-267-2912. The new clevis is suitable for towing cross country and has a rated capacity of 70 tons.

## **Servicing Tires Safely**

Tires are essential to the Army. They're everywhere, used constantly. There are tactical tires, earth-mover tires, and front and rear tractor tires. They have drop-center rims, semidrop-center rims, flat-base rims, advanced rims, military rims, and earth-mover rims. Despite their differences, all tires have one thing in common. They all must be serviced—and serviced safely!

Tires are constantly subjected to damage. They are cut by sharp objects and banged up by bad roads, stones, and road shocks in general.

People who service tires are subjected to injury, too. In FY 91, 47 tire-related accidents were reported. The most common injuries were fractures and strains.

### **Repairing and inflating tires**

Fifty-six accidents occurred to personnel repairing and servicing tires. Inflating tires was the leading cause of accidents. Other accidents involved removing, demounting, and mounting tires. Injuries occurred during inflation to personnel not using an inflation safety cage or long hose, sitting on the tire, or using a cage that was not properly constructed. Improper tire size caused seven of these accidents. For example, a 16-inch tire was mounted on a 16.5-inch rim and then overinflated without a safety cage. The tire exploded, and the soldier broke his hand.

Another seven accidents involved lifting. Back strain, the most prevalent injury, occurred when soldiers tried to lift loads that were too heavy or used lifting devices incorrectly or not at all.

### **Injury prevention is easy**

- Always use a safety cage when inflating tires mounted on rims with demountable side ring flanges or lock rings. This is the only approved method of inflating tires.

- Never use unapproved methods such as placing a tire with the lock ring facing down, or with chains or straps around the rim. There is no authorized substitute for the safety cage.

- When adding air to a tire that has less than 80 percent of the recommended pressure, whether on or off the vehicle, put it in a tire cage. (This warning is being added to the PMCS in the operator's manuals for all tactical wheeled vehicles.)

- Never attempt to seat side ring flanges or lock rings during or after inflation. Improperly seated side ring flanges or lock rings can blow off.

- Never overinflate any tire to seat tire beads. If both beads do not seat properly when tire pressure reaches 40 psi, completely deflate the assembly. Reposition the tire on the rim, relubricate, and inflate. After beads are fully seated, pressure may be increased as specified by the vehicle technical manual.

- Use only tools designed for tire mounting and demounting. Don't use pick-mattocks or sledgehammers for breaking down tires. Take a look at TM 9-243, Care and Use of Hand Tools and Measuring Tools, for proper tool usage.

- Use approved tire lubricant to aid in mounting and demounting tires. Never use grease. It causes rubber to deteriorate. Lubricant, NSN 2640-01-282-2849, has the consistency of grease, which aids in sealing the bead to the rim.

- When in doubt about what to do, ask your supervisor for guidance before you continue.

### **Tire cages provide protection**

Inflation safety cages, generally called tire cages, should always be used when inflating tires mounted on rims with demountable side ring flanges or lock rings. It is a good idea to use the cage with other type rims also. The inflation cage shown in TM 9-2610-200-24, Care, Maintenance, and Repair of Pneumatic Tires and Inner Tubes, will meet all Army requirements and OSHA standards.

Cages may be built in various sizes to meet the needs of the unit. Users may make multiple tire cages, or a single cage may be built to accommodate both the smallest and largest tires a unit will repair. This requires making sure the openings on the sides and top of the cage are small enough to contain projectiles from an explosion of the smallest tire inflated in the cage.

In addition, users must always ensure that the cage is at least 4 feet from any wall. Space on

each side of the cage will help absorb the force of an explosion and help prevent movement of the cage.

Before a cage is used, its construction must be certified by facility engineers. TM 9-2610-200-24, TM 9-243, and OSHA Standard 1970.177 provide the certification standards. In addition to inspecting new cages, facility engineers will inspect any cage that—

- Has been damaged by rim separation and repaired.
- Has been repaired by using units.
- Is corroding excessively and for which the unit requests an inspection.

Cages must be visually inspected each day before use. Inspect for missing, broken, or deformed members due to mishandling or abuse. Check for severe pitting due to excessive corrosion.

#### **Field conditions don't change the rules**

Placing multipiece rims lock ring down or wrapping rims in chain or straps is not authorized. Units in the field, away from installation maintenance shops and tire cages, should deploy with a tire inflation cage.

#### **Mistaken identity on tires/rims can cause problems**

The CUCV and the M880 series rims can easily be mistaken for each other. Appearance and lug hole patterns are similar. Correct rim size can be determined by a stamped size 16x6 on the outside of the CUCV rim. The M880 series rim is stamped 16.5x6.75 on the inside of the rim. TACOM recommends that each unit having CUCV and M880 vehicles identify and stencil each rim. The stenciling process can be accomplished using white paint and a minimum 2-inch stencil size. Stencil "CUCV" or "M880" internally on the drop center well near the valve stem hole. This location will not interfere with camouflage requirements and is least susceptible to dirt and grease buildup. TACOM recommends the stenciling process be done during the next scheduled maintenance interval.

#### **To make the job easier**

All units should have certain tools on hand. Some items come in the No. 1 common tool set while others must be ordered separately. All items are Class 9 and can be replaced through PLL or supply rooms. A minimum service set includes:

- Air hose and gauge, NSN 4910-00-441-8655.
- Chuck air lock, male, NSN 4730-00-720-7076.
- Chuck air lock, female, NSN 4730-00-277-6948.
- Constrictor, tire (M880 and CUCV), NSN 4910-01-242-1370.
- Gauge tire pressure, NSN 4910-00-203-2170.
- Gauge tire pressure, NSN 4910-00-204-2644.
- Lubricant, tire, NSN 2640-01-282-2849.

## Rings and Things

Rings and things are great—some places. AR 670-1 authorizes the wearing of a wrist watch, an ID bracelet, and two rings with Army uniforms unless prohibited for **safety or health reasons**. But some soldiers wear them at the wrong time and place.

- The soldier lost his balance as he dismounted the 5-ton truck on which he was performing maintenance. He grabbed for the rearview mirror, and his ring caught on the mirror support bracket. As he fell to the ground, the ring ripped off his left ring finger at the first joint.

- The soldier was working on the 5-ton wrecker in the motor pool. As he climbed down from the wrecker, his ring caught on a metal pin on the boom. He reached up to free the ring and lost his balance. His ring remained snagged on the boom, and the weight of his falling body severed his finger at the middle knuckle.

- After taking the tarp off his load, the soldier jumped off the trailer. His class ring caught on the sideboard and severed his right ring finger just below the middle knuckle.

- While unloading equipment, the sergeant jumped off the trailer. A ring on his little finger caught on a hook that houses the canvas, and his finger was cut off.

Sound a bit repetitious? It is. And these losses were so unnecessary.

The SOP in DA Pam 750-35, which must be established in each motor pool throughout the Army, contains a safety annex that states: "Remove all jewelry (i.e., rings, chains, watches) when working on equipment."

One safety item listed in DOD 4145.19-R-1, the regulation on handling material, states: "Finger rings will not be worn."

Regulatory guidance clearly says rings will not be worn in motor pools, maintenance shops, when working on equipment, or when handling material. In addition, commanders have authority to require soldiers to remove rings in other places and at other times for "safety or health reasons."

So why are soldiers still wearing rings and losing their fingers? Don't they know they shouldn't wear the rings? Doesn't anyone ever check? Aren't the regulations enforced?

### References

- AR 670-1: Wear and Appearance of Army Uniforms and Insignia.
- DOD 4145.19-R-1: Storage and Materials Handling.
- DA Pam 750-35: Functional Users Guide for Motor Pool Operations.

## Carbon Monoxide Is Sneaky Killer

### CO in tactical vehicles

- Because of the extreme cold, guards were allowed to run the heater in the truck-mounted shelter for 10 minutes each hour. They were instructed to open vents and have adequate ventilation. The soldier was discovered inside a sleeping bag in the shelter with the vents closed and the heater running. He died of carbon monoxide poisoning.

- To keep warm, the sergeant slept on the deck of the M730 Chaparral carrier with the main power unit running. Shortly after being awakened, he collapsed. He was taken to the hospital where he was treated for carbon monoxide poisoning. Luckily, he survived.

Carbon monoxide (CO) is a gas you cannot see, taste, or smell. It won't tickle your throat or make your eyes smart, or in any other way make its presence known. Carbon monoxide is dangerous because it sickens and kills by cutting off the oxygen supply from the body's tissues.

The oxygen one breathes combines with red blood cells and circulates through the body. Just breathing oxygen isn't enough. It must combine with the red blood cells to maintain life. CO combines with red blood cells 200 times more easily than oxygen. When oxygen and sizable amounts of CO are breathed together, CO displaces oxygen. Air containing one percent carbon monoxide can kill a person within 5 minutes. And it all happens without a sound.

### Symptoms

The symptoms of carbon monoxide poisoning are tightness across the forehead followed or accompanied by throbbing in the



temples, headache, weariness, weakness, dizziness, nausea, loss of muscular control, and increased pulse or respiration.

### **Precautions**

Soldiers often seek warmth without considering the danger. The following precautions will help ensure safety:

- Do not operate vehicle heater or engine in an enclosed area unless it is adequately ventilated.
- Do not idle engine for long periods without maintaining adequate ventilation in personnel compartments.
- Do not drive any vehicle with inspection plates, cover plates, or engine compartment door removed unless necessary for maintenance purposes.
- Be alert at all times during vehicle operation for exhaust odors and exposure symptoms.
- Do not sleep in tightly enclosed areas, near vehicle exhaust, in vehicle cabs, or in generator trucks.

The best defense against carbon monoxide poisoning is adequate ventilation, whether it is in the home, a vehicle, or workplace. Remember, carbon monoxide gives no warning of its presence. It sneaks in.

## **Batteries Need Careful Handling**

- Sergeant was jump-starting a D-8 dozer. When he connected the last jumper cable, the battery exploded in his face.
- Employee was carrying a filled battery when the handle broke. When the battery fell, acid splashed into his eyes.
- Supply clerk was lifting a battery to place it on a pallet when the carrying handle broke. The battery landed on his right foot.
- Mechanic was on top of an M60 handling batteries to his coworker inside. His back made a sudden snapping noise, and he couldn't straighten up.

These are samples of the injuries batteries cause Army personnel. Harmless-looking as they are, batteries should always be handled as if they were potentially dangerous, because they are.

Batteries do splash acid on people, and they do explode. They are also heavy and awkward to handle. In fact, the leading type of battery-related injury involves sprains and strains.

### **Lifting batteries**

There is no quick and easy way to hand batteries down into a tank. It must be done deliberately and cautiously, with alertness, to avoid twisting and overexertion. Mechanical means should be used to move batteries whenever practical. In other situations, two people may do the lifting. The rule to follow is: When in doubt, get help.

### **Protective equipment**

The electrolyte in batteries is corrosive and may splash or drip out. Sealed goggles and rubber or acid-resistant gloves must always be worn when handling them. When performing battery maintenance, people should wear face shields and acid-resistant aprons in addition to the gloves.

The handles of some batteries can become saturated with electrolyte and can become corroded and break. It's safer to use a battery carrying clamp or handle. If the built-in handles are used, the battery should be held away from the body when carried—just in case—and, of course, steel-toed shoes should always be worn.

### **Battery types**

Different types of batteries present different hazards in varying degrees. But all batteries require great care in handling and respect for their injury-causing potential.

Primary cell batteries—nonrechargeable, disposable types such as zinc-air, mercury, carbon-zinc, and alkaline—are in common use. They should be turned in for disposal when they show signs of leaking electrolyte, corrosion, or unusual temperature increase. One type, lithium, is increasing in use in equipment such as night vision devices. The lithium battery is a high energy density power source with highly reactive components. These batteries may emit corrosive and highly toxic chemicals if not handled with care. As is the case with other primary batteries, any attempt to recharge them could set off a violent chemical reaction.

A battery that has a charge-discharge cycle is known as a secondary battery. The most commonly used types are alkaline, with potassium hydroxide solution as the electrolyte, and lead-acid batteries in which sulfuric acid solution is the electrolyte.

The lead-acid storage battery stores power for the electrical system in most vehicles. Proper care of this battery is most important. Excessive charging or discharging shortens the life of the battery and the electrical accessories. Distilled water should be added as needed to keep the liquid (electrolyte) level above the battery plates.

In both alkaline and lead-acid batteries, chemical changes take place during the charge and discharge functions. These changes produce hydrogen gas. This gas, contained in the bubbles you see through the vent hole, can explode if ignited. Ignition sources include the obvious—matches and lighters. Then there are the less obvious sources. Tools falling on batteries and causing a spark have produced many explosions.

Caution your people always to take two precautions to protect themselves from battery explosions:

1. Keep all possible ignition sources away from batteries.
2. Keep face away from battery as much as possible and use eye protection.

### **Jump-starting**

Batteries are prone to explode during jump-starting. This is especially so if the jump-starting is done incorrectly. Therefore, always have your people wear eye protection, keep their faces well back, and follow proper procedures to the letter:

- Connect only batteries of the same voltage.
- Check dead battery for damage and electrolyte level. Add distilled water if necessary. If battery is damaged or electrolyte is frozen, do not jump-start. There might be gas pockets in the ice.
- Get the good battery and the dead battery as close together as possible, but don't allow the vehicles to touch.
- Place vehicles in "park" or "neutral" with emergency brakes ON and ignitions, master switches, and all electrical and electronic switches OFF.
- Cover vent openings of both batteries with rags to prevent possible battery-acid splatter.
- Connect one red-end clamp to the positive (+) battery post of the dead battery. If you can't see the positive (pos, P, or +) or negative (neg, N, or -) markings on the post, don't guess! Forget it until you can absolutely identify which is which.
- Connect the other red-end clamp to the positive (+) post of the good battery.
- Connect one black-end clamp to the negative (-) post of the good battery.
- Carefully connect the other black-end clamp to some large metallic part of the dead vehicle's engine block. If the battery is not in the engine compartment, connect to the frame or some unpainted part of the body. This final connection is the one that sparks, so keep it as far from the battery as possible. Never connect the cables to the dead battery's negative (-) post. Take special care to keep the jumper cables away from the fan belt or other moving parts.

Start the working vehicle, and run it at idle. Then start the other vehicle.

- Once the other vehicle is running, immediately disconnect the jumper cables in the exact opposite order from that in which they were connected. The first cable you disconnect will cause a spark, so remove the one farthest from the battery first. This time it's (1) black-end clamp from engine or frame; (2) black-end clamp from good battery; (3) red-end clamp from good battery; (4) red-end clamp from formerly dead battery.

To jump-start or slave-start wheeled or tracked vehicles, place vehicles side-by-side if possible; otherwise, park them at right angles (with main guns traversed to the rear). Do not allow anyone to be between the vehicles, and clear the front. Vehicles being jump-started have been known to jump forward.

For additional jump- and slave-starting guidelines, consult the applicable vehicle manual.

### **Precautions**

Battery charging areas should be well-ventilated and equipped with eye-wash and shower facilities. If electrolyte gets in the eyes, they should be flushed for at least 15 minutes in running water with the eyelids held open. Complete drenching is called for in cases where electrolyte contacts the body. Follow-up treatment in a medical facility is mandatory.

Incineration of batteries is hazardous and is not an acceptable method of disposal. All unusable batteries should be turned in for disposal in accordance with the appropriate parts manual.

## Tires Are Major Safety Device

The second most important safety device on a wheeled vehicle (after the brake system) is its tires.

Correct air pressure is the basis for reliable tire performance. Tires are designed to operate at specified air pressures, which are normally different for light and heavy loads and for different operating conditions. It is important that the pressure be checked at least weekly using an accurate gauge and inflation adjusted as indicated. A tire that appears low during the daily preventive maintenance checks and services (PMCS) should be checked with a gauge, too.

Why all the bother? To help preserve the tires and also the vehicle, driver, and passengers.

- Underinflated tires will give the vehicle a sluggish, squashy feel, and can make the vehicle hard to control in a crisis.

- A tire that's only 25-percent low—hardly enough to see—can lose one-fifth of its useful life.

- Underinflated tires waste fuel.

- Underinflated inner duals can cause costly and dangerous fires.

- A tire that is operated while underinflated will show greater wear on the outside edges of the tread than in the center.

- Overinflation also causes tire failure. Excessive pressure prevents the tire from flexing enough, so that it is repeatedly subjected to hard jolts. The cords may snap, causing a break in the cord body.

- A tire that is overinflated will show greater wear on the center of the tread than on the outside edges.

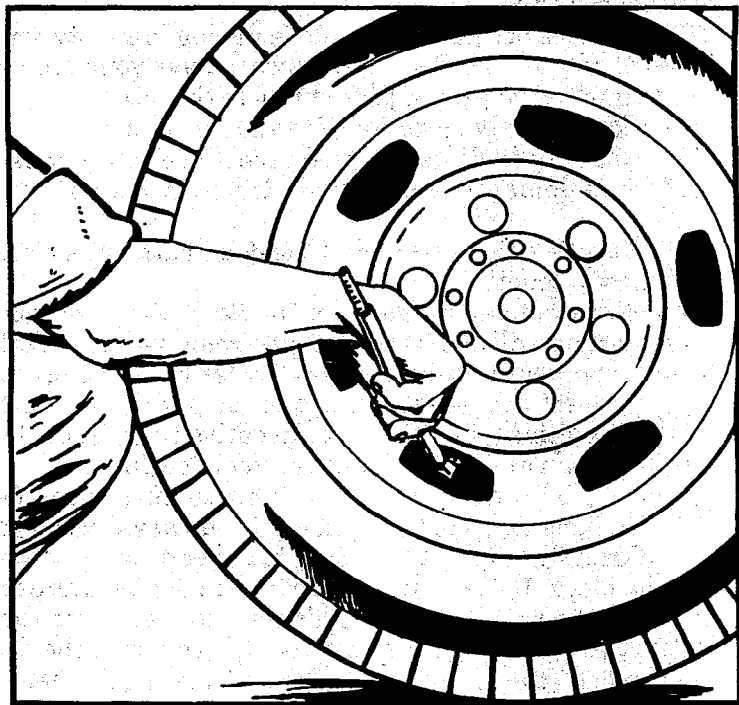
All inflation pressures are cold inflation pressures. This is the pressure after the tire has been standing for at least 3 hours or driven less than 1 mile after standing for 3 hours. The inflation pressure will increase as the tires warm up. Air should never be bled from hot tires to reduce the pressure to the cold inflation recommendation.

Normally the tire pressure check will be performed in conjunction with the other weekly PMCS. When your unit goes to the field, be sure a tire pressure gauge is included with those minimum-essential tools that go along. A vehicle with its own air supply (2 1/2-ton and larger) also has its own gauge, but be sure there's one available for the smaller vehicles. If a tire is found to need air, you can get it from a wrecker or other air-supplied vehicle.

A daily check of the outside of the tire is essential, too. If it has any gouges or cracks that could cause fire failure, any sidewall or tread bulges that indicate ply separation, tread depth less than 1/8-inch, or exposed cords, replace it before driving the vehicle.

Tires are constantly subjected to cuts by sharp objects and bruises from rough driving surfaces, stones, and shocks in general. It would seem to be plain common sense not to trust your life to a tire that looks like it's just waiting for the right minute to blow out, but a recent fatal Army motor vehicle accident began with the blowout of just such a tire.

The daily visual inspection and weekly tire pressure check take only a few minutes, and they are minutes well spent for safety, riding comfort, and protection of equipment.



## **Preventing Back Injuries**

Use of improper lifting techniques, failure to use materiel handling equipment when needed, and failure to get help in lifting, pushing, or pulling heavy or awkward items cause most of the Army's back injuries. People often risk back injury by trying to handle a load by themselves rather than take the time to get the help or equipment they need.

Persons who manually handle materials of any type should be instructed in the proper method of lifting heavy objects. The following proper lifting methods were extracted from DOD 4145.19-R-1, Storage and Materials Handling. Incorporate these procedures in your training programs.

### **Proper lifting method**

Persons who manually handle materials of any type will be instructed in the proper method of lifting heavy objects. The proper way to lift heavy objects from the floor is for the lifter to stand close to the load, with feet slightly apart and solidly placed. With knees bent, the object will be grasped firmly and lifted by straightening the legs, keeping the back as nearly vertical as possible.

When lifting from an elevated surface, the object will be brought as close to the body as possible to avoid an unbalanced position. With straight back the lifter will keep the load close to the body and will avoid carrying a heavy load a long distance without resting. The load will be carried in such a manner that full view is permitted.

When lifting with another person, both persons should start and finish the lift simultaneously to prevent undue strain on either person. Persons with existing hernias, or those who have a history of previous back strains, will be assigned to duties that do not require heavy lifting. Lifting or lowering operations performed by several persons will be done on signal from one individual, and only after everyone's feet, hands, and other portions of the body are clear. Generally, mechanical means will be used for handling heavy objects.

### **Precautions for manual handling**

Safety precautions which apply to manual handling of materials include the following:

(1) Protective clothing or accessories, including gloves, face shields, goggles, and safety shoes will be worn.

(2) Finger rings will not be worn.

(3) Material will be examined for sharp edges, protruding points, weakened places of ropes, or other factors which may cause injury to personnel. These defects should be corrected before proceeding.

(4) All stacked cargo and materials will be arranged in an orderly manner for convenient and safe handling.

(5) Defective or broken strapping on cargo will be removed, repaired, or replaced. Face shield or goggles and proper gloves will be worn when cutting steel strapping, and personnel will stand out of the way of a snapping line of cut strapping.

(6) Drums will be rolled by pushing with the hands, not the feet.

(7) Material will not be thrown from elevated places to the floor or ground. Use suitable lowering equipment.

(8) Wheelbarrows, hand trucks, and other similar devices will not be overloaded. These devices will be pushed, not pulled except when going up inclines.

(9) Ropes, used for carrying, towing, or for life or scaffold lines which have defects, will be replaced.

(10) Chisels, hammer faces, and pliers which have burred, chipped, or badly worn working surfaces or edges will be replaced to prevent serious injury to eyes, hands, or face.

(11) Appropriate tools will be used for each job. For example, nail pullers will be used for opening boxes, strap or wire cutters for cutting metal strapping or wire, and hammers for driving nails.

(12) Plugs will be disconnected when electrical power tools are not in use.

(13) Sharp-edged tools will not be carried unshielded in pockets.

(14) Hand-operated trucks, dollies, and similar equipment will not be parked in traffic lanes or roadways.

(15) Cylindrical objects will be blocked to prevent rolling.

(16) When working at high elevations a lifeline and safety belt will be worn if other safeguards are impractical.

(17) Personnel will not reach around, over, or under the moving part of any machine.

### **What everyone should know about lifting**

1. Never try to lift beyond your own strength. Get help!
2. Always crouch down to what you are going to lift.
3. Get a good footing. Place feet 8 to 12 inches apart.
4. Get a firm grip with fingers underneath the load whenever possible.
5. Keep your arms straight and keep your back in as near a straight up-and-down position as possible.
6. Lift gradually. Avoid jerky motions.
7. Avoid twisting motions by shifting the position of your feet.
8. Lift by standing up or pushing up with the strong leg muscles. This takes the strain off the back muscles.
9. Put things down by generally reversing the lifting methods.
10. Your job may involve handling of cases, boxes, baskets, drums, or shaped containers, under unusual conditions. Check your methods of lifting these with your foreman to make sure they are safe and proper.

### **Checklist for supervisors**

- Identify those people who must regularly lift, push, or pull heavy items. Make sure these people know how to lift properly to avoid strain and that they should always get help with heavy or awkward items.
- Become familiar with the physical requirements of all civilian employee's job descriptions and ensure task assignments do not exceed those requirements.
- Tell people to report any materiel handling requirements which involve strain or risk of injury or damage to the materiel.
- Correct improper lifting techniques on the spot.
- Evaluate operations to determine the need for materiel handling equipment. Indications are employees raising or lowering loads by hand; employees repeatedly carrying loads long distances; and employees pushing or pulling loads without using aids.
- Take action to get needed materiel handling equipment.
- Investigate complaints of back pain to determine whether the cause is job related. If it is, work to correct the problem.

## **Emergency Eyewash Fountains**

The U.S. Army Environmental Hygiene Agency recently published the following guidance on the use of emergency eyewash fountains.

The OSHA General Industry Standards, Title 29 Code of Federal Regulations (CFR), Part 1910.151, states: "Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use." This requirement is based on the fact that chemical burns of the eyes need immediate first aid attention. Any delay in treatment will generally aggravate the injury.

The initial treatment of choice is active mechanical flushing of the eyes with an ample supply of water. The American National Standards Institute (ANSI) Standard Z 358.1-1981 for Emergency Eyewash and Shower Equipment states that active irrigation should continue for a period of 15 minutes. This amount of time is considered adequate, depending upon flow rate for even the more serious chemicals; e.g., alkalis and strong acids. All employees with a potential exposure to corrosive materials should be instructed in the proper use of eye-lavage fountains and the length of time necessary to flush the eyes.

Providing 15 minutes of eye/face irrigation requires a considerable volume of water. Based on

information from the ANSI Standard Z 358.1-1981, the flow rate (gallons per minute (gpm)) will not be less than 3.0 gpm for emergency eye/face wash equipment. Eyewash equipment (plumbed and self-contained) will be capable of delivering to the eyes not less than 0.4 gpm for a period of 15 minutes. There is a wide range of injurious materials which can enter the eye and cause injury. The discrepancy between a total volume of 6 gallons and 45 gallons is dependent upon the hazard and its potential effect on the eye and face. Obviously, the larger volume (3 gpm for 15 minutes) is for a strong acid or caustic where it is necessary to wash the eyes and face.

Portable eye fountains generally are sealed units which work on a pressurized system. The tanks are pressured by use of a hand pump. The possible loss of pressure requires increased maintenance checks to recharge if necessary. The unit may fail to function because of a lack of interest in maintenance. Squeeze bottles and other plastic container devices have a water capacity less than the portable pressurized eye fountain and generally will not meet the flow rate and duration prescribed in ANSI Z 358.1-1981. They will often lose water through evaporation and become contaminated because of disuse and poor maintenance. They are easily misplaced and may not be available in an emergency.

Based on the above considerations, the following guidance is provided on the installation of emergency eyewash systems:

- Eyewash squeeze bottles and other such plastic devices are not appropriate emergency eyewash systems and should not be used under any conditions.
- In all areas requiring an emergency eyewash capability, every effort will be made to install permanent eye-lavage fountains of the type described in paragraph 11-3F, DA Pam 385-3, Protective Clothing and Equipment, 3 May 1976.
- No portable eyewash fountains will be permitted in areas where a chemical splash hazard exists and where there is a continuous source of clean water available.
- Portable eyewash fountains may be allowed in remote areas when no continuous flow of fresh water is available, the installation of a fresh water system is not economically feasible, and the hazard to chemical splash is minimal; e.g., in bulk storage areas.
- Self-contained (portable) units will be constructed of materials that will not corrode in the presence of the flushing fluid. The only portable lavage station that will be permitted are those delivering a flow rate of 0.4 gpm for a minimum of 15 minutes duration, and capable of irrigating both eyes simultaneously.
- Eyewash and eye/face wash units will be in accessible locations which require no more than 10 seconds to reach. They should be within a travel distance of no greater than 100 feet from the hazard and should not require a round-about route for access (i.e., up or down steps, in and out various doors or aisles). The maximum time required to reach the eye/face wash should be determined by the potential effect of the chemical. With a strong acid or caustic, the eye/face wash should be immediately adjacent or within 10 feet of the hazard.
- All eyewash units, whether plumbed or self-contained, will routinely be checked. Plumbed eyewash units will be activated weekly to flush the line and to verify proper operation. Self-contained units will be inspected in accordance with the manufacturer's instructions.

## Stop Brake Failures

Faulty brakes are a frequent cause of Army motor vehicle accidents, especially in 2 ½-ton and 5-ton trucks. Brake system failure is the largest—maybe even the single greatest—cause of maintenance-induced AMV accidents.

Army vehicle drivers are responsible for keeping their vehicle in safe operating condition and for maintaining its mechanical efficiency. They are the most important single factor in preventive maintenance. Established preventive maintenance checks and services (PMCS) done regularly and thoroughly are the driver's means of ensuring a safe, efficient vehicle.

During the daily maintenance inspection, drivers should pay extra attention to the brake system and check it carefully.

Most brake accidents are caused by failures of brake lines, air hydraulic cylinders, parking brakes, wheel cylinders, and master cylinders. Both drivers and maintenance personnel must pay close attention to these components.

In addition to operating the service brake to determine stopping ability and to setting the hand brake to determine the parking brake's ability to hold the vehicle, the driver should check brake hoses and brake lines. This can be done when looking for evidence of fluid leakage. If a brake hose is stretched, bent, or cracked, it should be replaced. Any brake line that is leaking or damaged should be reported to Organizational Maintenance so they can replace it. If there is a loose fitting or connector, it should be tightened.

The driver should check the inside area of all four wheels to be sure there are no fluid leaks from the wheel brake cylinders. He can check the hydraulic brake fluid in the master cylinder if he finds the brake pedal sinks too close to the floorboard. To do this, he will need to open the master cylinder, located on the driver's side of the cab floor, and use a flashlight to see into the master cylinder reservoir to check the fluid level. Lack of fluid in the master cylinder is a frequent cause of brake system failure accidents.

Vehicles are not to be operated with defective brakes. When brakes do not function properly, the driver should leave the vehicle in place and notify Organizational Maintenance. Maintenance personnel should deadline and physically attach a red tag on any vehicle with defective brakes. When they move the vehicle with defective brakes for maintenance, that vehicle must be towed using an approved tow bar.

Brake failure accidents can be reduced greatly by the following actions:

- Make it unit policy that preoperational checks—with special emphasis and attention on brake systems—be performed by the driver before accepting any vehicle.
- Hold drivers responsible for making these preoperational checks.
- Have first-line supervisors enforce and supervise the driver's preoperational checks.
- Require drivers to check master cylinder and the inside area of all four wheels to be sure there are no fluid leaks.
- Have drivers start their vehicle, let it move forward about 3 feet, and try the brakes once again. Make sure the brakes hold.

## Bubble Trouble

A mechanic who had a small cut on his finger washed some machine parts in cleaning solvent. Then, holding the parts in his hand, he dried them by blowing compressed air over them. Shortly afterward, he complained that his body and head felt as if they were going to explode.

At the hospital, his ailment was diagnosed as air bubbles in his bloodstream. The man recovered, but he could have died.

People use compressed air to blow dust and dirt from their clothing or from their hair, and ear and eye injuries have resulted. There have also been cases in which a blast of air playfully directed behind a worker startled him and caused him to fall against moving machinery.

To prevent accidental injuries, remind your workers to observe these precautions when they work with compressed air:

- Wear eye and other special protective equipment required for the job.
- Don't kink the hose to stop the air flow. Always turn off the air at the control valve.
- Check the air hose carefully to make sure it is in good condition before opening the valve to let air into the hose. Turn off valves on both the tool and the air line before leaving a pneumatic tool.
- Avoid using compressed air for any type of cleaning, except as a last resort. In those special cases, the pressure should be reduced to less than 30 psi and effective chip-guarding and proper personal protective equipment should be used.
- Never point a compressed air hose nozzle at any part of your body or at another person.
- Never use compressed air for a practical joke.

## **WARNING! AMV Brake and Clutch Maintenance Can Be Health Hazard**

**This article first appeared in the April 1985 Countermeasure. It has been updated by Mr. J. Earl Swindell, Preventive Medicine Service, Fort Stewart, GA, to reflect current asbestos control procedures. Mr. Swindell has also supplied detailed procedures for asbestos control during brake and clutch repair that can be included in your SOP or LOI. If you would like a copy, write U.S. Army Safety Center, ATTN: CSSC-M, Fort Rucker, AL 36362-5363, or call AUTOVON 558-2062/4806.**

The last time one of your AMV mechanics used an air hose to blow out a brake drum, he sent a cloud of asbestos fibers freewheeling through the air and probably right into someone's lungs.

Remember that gray-black powder that fell on the floor when he pulled the brake down? That contained asbestos fibers which are dangerous when inhaled into the lungs.

Some of our vehicle maintenance manuals have no danger or warning about these asbestos hazards, but they should—and will as soon as the changes are published.

Asbestos has been found to produce severe lung damage in the form of disabling or fatal fibrosis of the lung, termed asbestosis. It has also been found to be a factor in the development of lung cancer and is suspected of contributing to cancer of the gastrointestinal tract. The effects of asbestos exposure are not immediate, but can show up 20 to 30 years after the first exposure. It has been found that smokers who work with asbestos have a much higher potential of developing lung cancer than do nonsmokers. Those who stop smoking will gradually reduce this risk to a level no greater than that of nonsmoking asbestos workers.

When a mechanic is servicing or replacing components containing asbestos, the "solvent method" or "enclosed cylinder/HEPA vacuum system method" are the preferable procedures to use. Both reduce the risk of exposure to airborne concentrations of asbestos by keeping the airborne concentrations of asbestos within permissible exposure limits. The effectiveness of these procedures can be verified by an industrial hygiene evaluation.

If it's not possible to use either method, personnel must implement effective engineering controls and use approved respiratory protection directed by AR 40-5: Preventive Medicine; 29 CFR 1910.1001: OSHA Asbestos Standard (effective 21 Jul 86); and TB Med 502: Occupational and Environmental Health Respiratory Protection Program.

It's also possible to be exposed to hazardous airborne concentrations when sweeping dry dust or when dumping a trash can containing asbestos dust. Use precautionary measures for these jobs, too.

These recommendations are general and should be supplemented with more rigid and specific guidance depending upon results of the required initial and periodic industrial hygiene surveys and evaluations. Contact your local MEDDAC/MEDCEN Preventive Medicine Service Industrial Hygienist for assistance.

## **POL Disposal**

Hazardous material is defined as any substance or components of such that, when handled improperly, could or would expose one to risk or contaminate the environment. With this in mind, how many times have troops performing maintenance on their equipment caused a hazardous material (POL) spill? After the spill was cleaned up, what did they do with the compound they used to clean up the spill? Did they know that now they also had a hazardous waste product to dispose of? This article will discuss the proper disposal of petroleum, oil, solvents, and fuels, and their waste byproducts.

In the maintenance field, we deal with hazardous products every day. Some of these we

handle without giving a thought to what a spill could cause. Some of the products are used as cleaning agents, fuel for vehicles, and lube oils. Each of these has waste byproducts that must be disposed of in accordance with rules set by the Department of Transportation (DOT) and the Environmental Protection Agency (EPA).

For example, when we clean up a small oil spill with a few rags, the rags become a hazardous waste byproduct that must be shipped to the disposal site. Before we can do this, however, we must place them in a container that meets the standards set up in 49 CFR 101.1. The container also must be properly labeled. This is the minimum requirement simply to move the product from the maintenance area to a disposal site.

Unit maintenance SOPs should discuss proper disposal of waste oil and solvents. The SOP must conform to the laws and controls set up by DOT and EPA. The drum the product came in may be used for disposal. Copy all the information on the label and then paint the waste drum with traffic yellow paint from your local self-service supply center. Mark it with the words "Waste Products" in 4-inch letters and add the information you copied from the label. Make sure you don't mix products. In other words, oil should not be mixed with solvents or fuels. A normal motor pool would have as many as six 55-gallon drums, one each for waste oil products, waste solvents, waste fuels, oil rags, contaminated floor sweep products, and contaminated ground dirt. Each has different label requirements under 49 CFR 101.1. Hazardous waste product labels can be obtained from the safety office, facility engineer, or transportation office.

A post or installation that fails to meet requirements can be fined as much as \$25,000 a day per incident. That's a lot of money, and the Army may take UCMJ action against an individual soldier for not following procedures.

As maintenance personnel, it is our responsibility to ensure that hazardous materials and their byproducts are handled and disposed of in the proper manner. The dry sweep, rags, or other materials used to clean up spills in and around shops and motor park areas must not be put in the local dumpster or trash cans. The local facility engineers can assist you in determining the proper method of disposal. Call them when questions arise.

## **Mission Protection Measures for the Motor Pool**

Motor pool operations are a prime hazard area and require constant inspection to reduce risks. Examples of things you should look for in your inspections are:

- Improper lifting.
- Not wearing gloves, goggles, hardhats, safety shoes, respirators, and hearing protection where and when required.
- Potential slipping and tripping hazards such as grease and litter on floors.
- Cords or other obstructions across aisles.
- Barricades left down.
- Worn electrical wiring.
- Climbing on chairs or makeshift stands.
- Unblocked and unchocked vehicles.

Make the following common practice in your motor pool:

- Ban the use of gasoline to clean parts or hands.
- Require the use of the right tool for every job and never allow use of makeshift maintenance stands.
- Clean up spills and pick up litter immediately.
- Ban the wearing of jewelry of any kind while working in the motor pool.
- Require the wearing of protective equipment while on the job.
- Keep firefighting equipment in ready condition and easily accessible at all times.
- Check power tool cords at frequent and regular intervals for worn spots or cuts.
- Require the use of a tire cage when inflating split rim truck tires and make sure it is used correctly.
- Keep grease pits covered or guarded by a chain barrier at all times.
- Require crews to roll up shirt sleeves when working around moving equipment, especially vehicle engines.
- Avoid buildup of toxic gases during engine tests and tuneups. Whenever possible, tune engines outdoors. If work must be done indoors, use extension hoses, preferably powered local exhaust hoses, to vent exhaust fumes outside.
- Provide hearing protectors, earplugs, or earmuffs and enforce their use in your motor pool.

# Using personal protective equipment

**Fact: Personal protective equipment is required to protect soldiers from on-the-job hazards that can't be controlled. It must be worn to provide protection.**

## **Safety points:**

**Eye protection.** Flying objects (especially from hand tool use), abrasive sheets, corrosive substances (solvents, battery acid), light or heat rays (infrared, ultraviolet), and metal particles are causes of eye injuries in maintenance activities.

These hazards are always present during welding, cutting, soldering, chipping, grinding, and a variety of other operations. Wear welder's helmets, face shields, safety glasses, or goggles during these operations.

**Welder's apron.** When welding, always wear a leather welder's apron to prevent burns on the upper and lower torso of the body from flying sparks and welding slag.

**Gloves.** Hands are always getting hurt. Gloves will prevent many burns, cuts, blisters, and punctures. They'll also help you get a better grip on your job.

General purpose gloves are for lifting heavy items or for handling rough, scaly, or splintery objects.

Rubber gloves protect against acids, caustics, other chemicals, oils, and solvents. A specially designed rubber glove is used to protect against electric shock.

Asbestos gloves and mittens protect against sparks, radiant heat, or hot objects.

**Ear protection.** Hearing loss is the Army's No. 1 occupational health injury.

Equipment and power tools generate noise.

—M88A1 recovery vehicle (inside): approximately 95 decibels

—APC: approximately 115 decibels

—Air wrench: approximately 107 decibels

—Grinder: approximately 92 decibels

—Rivet gun: approximately 110 decibels

Any noise above 85 decibels is hazardous. Exposure to hazardous noise for 5 years without hearing protection will produce a hearing loss similar to the hearing loss of a normal 60-year-old individual.

Use proper hearing protection regularly.

Wearing hearing protection reduces fatigue.

Rule of thumb: If you can't carry on a normal conversation because of noise, use hearing protection.

**Head protection.** Helmet liners and hard hats provide on-the-job protection.

From falling or flying objects.

To protect head from bumps and bruises.

To prevent your head hitting electrical cables or power lines.

To prevent getting your hair caught in moving or rotating machinery.

To keep dirt and dust out of your hair.

Always wear head protection when riding in a tracked vehicle or when operating construction equipment.

**Foot protection.** Injuries to the foot are painful and may result in permanent disability. Safety shoes give protection.

Some safety shoes are designed to limit damage to toes from falling objects.

Some safety shoes are designed for use where danger from sparking could cause an explosion.

**Respiratory protection.** Maintenance tasks such as spray painting or asbestos brake removal may require use of a respirator. Different types of respirators should be used for protection against such hazards as dust, vapors, or lack of oxygen.

# QDR/EIR Makes a Difference

Every Army publication sooner or later exhorts its readers to "send in those QDRs/EIRs." So, a soldier spots a problem and fills out an SF 368: Quality Deficiency Report/Equipment Improvement Recommendation (QDR/EIR). An acknowledgement of receipt and eventually a report of the action taken goes to the soldier. And changes are made. The system works.

Too often the reason you must live with a problem so long is that no one bothers to submit a QDR/EIR. Until a deficiency in equipment is known, it cannot be corrected. If an SF 368 is sent as a result of an accident, or is safety related, include the QDR/EIR number in block 33 of DA Form 285: U.S. Army Accident Investigation Report.

Your QDRs/EIRs do make a difference. Take a look at some changes the U.S. Army Tank-Automotive Command (TACOM) has made because of them.

## Case 1

- **Problem.** M35A2 2-ton truck synchronizers, NSN 2520-00-752-1581, were either too thick or tapered at the wrong angle to match gears, causing a lockup.

- **Solution.** TACOM Engineering reviewed the QDR submitted and found that the crux of the problem was in the dimension between the two rings. This dimension did not exist on the drawings. TACOM Engineering revised the

drawings to show the distance between the two rings.

## Case 2

- **Problem.** The ball studs in the steering lever assembly, NSN 2510-00-592-2258, of the M39 series 5-ton trucks would loosen and/or pull out, causing partial or complete loss of control. The ball studs were tapered and were not tight in the lever arm. If the ball stud ends did not protrude  $\frac{1}{16}$ -inch through the lever arm, the ends could not be mushroomed against the lever arm to secure them in the assembly.

- **Solution.** The assembly and detailed drawings were updated to correct design errors and clarify notes to ensure machining, hardening, and securing the ball studs in the lever arms. Field users were given inspection and disposition procedures regarding defective steering lever assemblies.

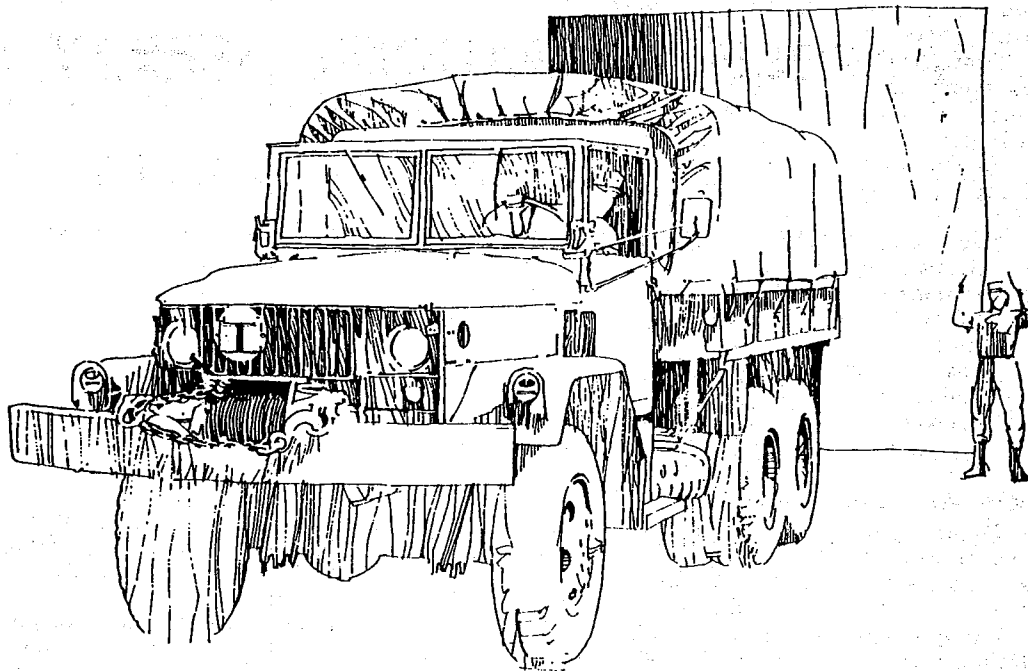
## Case 3

- **Problem.** The cargo body of the M884 1-ton truck with the S-250 shelter was breaking loose from the forward mounts. The shelter kit front tiedowns were connected to the cargo bed and not to the truck frame.

- **Solution.** The QDR not only stated the problem, it recommended the solution. The front tiedowns were anchored to the vehicle frame by extended bolts (through the body) attached to a piece of flat steel straddled underneath the frame rail.

# CHAPTER 5

## VEHICLE OPERATIONS SAFETY





## AMV Convoy Accidents

### Rear-end collisions most frequent

Most any day of the year an Army convoy will be on the road somewhere in the world. In too many of the convoys, there will be an accident.

A convoy accident is costly. Sure, a lot of them are only "fender benders." No one gets hurt, so the accidents aren't even reportable. However, fender benders can be costly to a unit.

Time spent in getting the vehicle back to the motor pool, filling out DA Form 2404 or maybe a DA Form 2407 work order, and getting the actual repairs done all add up. If an in-house report of survey is made, that takes away more productive time. If, during this fender bender, one of the soldiers was shaken up and two or three days later his back started hurting, more days could be lost.

Time spent in paperwork, in recovery and down time of equipment, and the productive work hours lost are all costs to the unit. The costs don't show up on the records, but jobs don't get done, schedules are not met, and mission objectives are "adjusted" for lack of personnel or equipment.

Convoy accidents occur at all hours, but the most frequent convoy accident occurs during the day to a driver who has been on duty 4, 6, or 8 hours; and it will likely be a rear-end collision.

A look at 242 AMV convoy accidents found a number of recurring factors cited as causing the accidents. They were:

- . Following too closely or misjudged distance.
- . Materiel failure.
- . Speed.
- . Environmental conditions.
- . Civilian vehicle hit AMV.
- . Blackout conditions.
- . Fatigue.

### Following too closely

Following too closely or misjudged distance was listed as a factor in many of the rear-end collisions reported. The sudden stop of the vehicle in front was added as a factor in many of the incidents with following too closely. Speed as a component of following too closely was listed in less than 10 percent of the rear-end collision accidents reviewed.

The guidance for following distance is found in FM 55-30 and in FM 21-305. Adequate following distance means you can stop in time if the driver in front of you suddenly applies his brakes. The safe distance is a combination of your speed, the road condition, the visibility, the condition of your vehicle, and your reaction time (the time required for you to react to a hazardous condition). The average driver's reaction time is three-fourths of a second. The general rule for a car is 20 feet for each 10 miles per hour under good conditions.

Use of the 2-second rule is a good way to maintain distance. Pick a road sign. When the vehicle in front of you passes it, count "thousand one, thousand two." If you pass the sign before "thousand two," you are following too closely. Back off some and repeat the test.

Under normal conditions on an open highway, the safe following distances for trucks are 300 feet in the daytime and 500 feet at night. (Don't get these distances confused with tactical road march distances as stated in FM 71-21). Remember, it would take a 5-ton truck moving at 20 mph 40 feet to stop. Driver perception time and reaction time plus vehicle stopping distance would make it necessary to have 84 feet at 20 mph to stop that 5-ton truck under ideal conditions. Not much time or distance to act!

Under any adverse condition, bad weather, darkness, or even driver fatigue, following distance should be increased. Drivers should give themselves every chance. This extra following distance could be the answer to those 22 reports which indicated "sudden stop of vehicle in front" as the cause of the rear-end collision.

## **Environmental conditions**

A dry, clear, cool day is the dream of an AMV convoy driver, but ice, snow, rain, fog, or dust conspire to cause him to have an accident.

Rain or wetness reduces the friction of the tires against the road. The wetter it gets, the more unsafe will be the posted speed limits. On wet surfaces, keep your speed down. Slow down before you reach a curve. Be cautious when you use the brakes. Give other drivers lots of room. Rain reduces visibility--yours and theirs.

Fog can thicken so quickly your vision is obscured. Keep your windshields clean and use low beam lights, to help a little. Rear-end collisions and running-off-the-road accidents increase during fog. Again, slower is better. The speed depends on the fog, but following distance needs to be increased.

Ice and snow keep being listed as factors in rear-end, impact and running-off-the-road accidents. Ice and snow mean slick roads, and slick roads mean stopping distances are greatly increased. Avoid sudden braking, as it will throw you into a skid.

Dust and smoke can be as thick as fog and obscure your visibility just as effectively. It can cause the eyes to smart and further reduce your vision. In any dusty condition, wear driver's goggles and, of course, slow down and increase stopping distance.

## **Speed**

Speed played the largest role in rollover accidents. In more than half of the reports which stated the vehicle rolled over, "excessive speed for existing conditions" was cited.

Convoy speed depends on the condition of the road and traffic and on the speed of the slowest vehicle. On long moves over rough roadways the speed should not exceed 15 to 20 mph with a prescribed maximum and catch-up speed of 25 to 30 mph. The maximum speed authorized for military vehicles on expressways is 50 mph. Military vehicles moving on controlled access highways will maintain the posted minimum speed, or 40 mph if a minimum speed is not posted. On other than controlled-access highways (conventional roadways), convoy vehicles will attempt to maintain a speed equivalent to the prevailing speed of other users of the highway or 45 mph, whichever is less.

## **Materiel failure**

Materiel failure was cited as a factor in all types of convoy accidents. Typical materiel failures were:

- . Tire blew out.
- . Generator and air compressor belts broke, causing total failure of the prime mover and trailer brake system.
- . Vibration sheared off wheel lug nut, which was not properly tightened.
- . Hydraulic brake system failed to function.
- . Cotter pin holding the linkage pin in the linkage sheared off, causing the linkage pin to vibrate out. This caused the brake pedal to disengage from the brake linkage, resulting in a loss of brakes.
- . Brakes defective due to puncture, chipped or excessively worn brake lining.
- . Vehicle was low on brake fluid.
- . Brake line fitting to the junction box at the rear wheel cylinder had vibrated loose and the system had lost brake fluid.
- . Left front tire came off in traffic because left tire-lug nuts were loose.

Convoy commanders are to have all vehicles inspected when they arrive at the convoy assembly area. Minor deficiencies are to be corrected on the spot. If deficiencies are detected that cannot be corrected on the spot, the vehicle should be returned to the unit for replacement. No vehicle should be accepted in a "might make it" condition.

All drivers have maintenance responsibilities. They must perform preventive maintenance checks and services before beginning operations. Drivers are to do a walk-around inspection and PMCS at all halts. As vehicles are being unloaded at destination point before the return trip or at the end of the trip, the driver does post-operation PMCS. On-the-road maintenance is performed by the driver. Mechanics in trail element perform repairs that are beyond the capability of the driver.

A goodly number of the materiel failures cited could have and should have been prevented by proper performance of PMCS. Drivers are the key to a successful convoy operation, but officers and NCOs are responsible for checking the welfare of the troops, security of loads, vehicle performance, and performance of at-halt maintenance.

## **Civilian vehicle hit AMV or hit by AMV**

Army vehicles, as large as they are, are difficult to see in the daytime, and especially so at night. Usually, when a civilian vehicle was reported as hitting an AMV in a convoy, it was reported as being a rear-end collision. These collisions occurred both day and night.

Provisions for making AMVs a little easier to see are found in AR 55-29, paragraph 6e(3), which states: "Convoy vehicles required to operate at night or during period of reduced

visibility will be marked with an L-shaped symbol at the lower corners of their tailgates. The symbol will be composed of a vertical stripe (12" long and 2" wide) and a horizontal stripe (12" long and 2" wide). The symbol may be applied with retroreflective paint (MIL-STD P98869), tape, or other reflective material. If paint is used, it may be applied directly to the vehicle surface or to some removable backing material such as masking tape. The length and placement of stripes applied to the rear of small vehicles or towed equipment may be governed by the available flat surface or visibility characteristics of the vehicles."

Reflective tape or paint and a functioning red taillight may give the civilian driver a better chance of seeing an AMV.

Trucks take a great stopping distance even at low speeds. Accidents were reported where civilian vehicles pulled out in front of a convoy and the AMV driver couldn't stop. Some AMV drivers had trouble making turns at intersections when other vehicles were there. At other times, AMV drivers pulled into intersections without looking, tried to pass when the way wasn't clear, and tried to "squeeze" by another vehicle and couldn't.

Proper driver training is essential for a safe convoy operation. Leaders must ensure drivers are trained and licensed and are held accountable for their driving behavior.

### **Blackout conditions**

Overdriving headlights is the most persistent problem of night driving. The eye can perceive objects only half as far at night as it can during the day. When a convoy goes out under blackout conditions, visual problems are definitely increased.

Military vehicles are equipped with blackout marker lights, two on the rear and on the front. Blackout marker lights do not illuminate the road but indicate the position of a vehicle ahead.

To reduce risk in blackout driving, be sure all blackout marker lights are functioning properly. Make sure they are clear of mud or accumulated road dirt. Drive at lower speeds. A man in the rear of a vehicle with a screened flashlight can warn a driver who follows too closely.

Remember, night driving with headlights is like driving by candlelight. In blackout driving, even the candle has been snuffed out.

### **Fatigue**

The majority of the convoy accidents reviewed occurred during the day. However, of those that occurred at night, 74 percent of the drivers had been on duty more than 12 hours at the time of the accident.

Peak periods for convoy accidents are June, July, and August. Heat would seem to be a factor adding to fatigue of the drivers.

According to AR 55-29, convoy vehicle drivers will be given an opportunity for 8 hours of rest for each 10 hours of driving within a 24-hour period. Rest periods will commence 12 hours before departure of the convoy.

## **Transporting the Troops**

. The 2 1/2-ton truck was traveling down a tank trail under blackout conditions when it hit a washout. The driver lost control, and the truck ran into a ditch. A soldier riding in the cargo bed was struck in the head and back when the tool cabinet broke free from where it was anchored.

. The soldier was riding in the back of an M817 dump truck that was towing an M105A1 cargo trailer. As the truck jolted over rough terrain, the soldier's foot slipped between the tailgate of the truck and the trailer. The trailer slid against the tailgate, catching his right foot and fracturing his big toe.

. The M1028 cargo truck was towing an M101A1 trailer under blackout conditions. The truck struck a ditch, throwing two passengers from the cargo bed. Both had a leg run over by the trailer.

. A field training exercise cleanup detail was riding in the back of the M925 cargo truck. Four detail personnel were sitting on the open tailgate with their arms over the hooked troop strap. When the driver accelerated to 20 mph, the increased vibration caused the tailgate to drop. The soldiers fell backwards, striking their heads.

These are some of the injuries that occurred to soldiers riding in the back of AMVs in FY 87. Most of them could have been prevented by the drivers.

Three types of driver error show up repeatedly. The most common is **driving too fast for conditions**. AMV drivers must be especially cautious when there are people in the back who cannot easily hold on and brace themselves.

Another driver error is **failing to ensure cargo is properly secured**. There are numerous examples in the accident records of passengers being struck by wire reels, spare tires, and the like.

The third type of driver error is **failure to ensure the safe seating of passengers**. Paragraph 2-17e, AR 385-55, requires that drivers transporting passengers in cargo trucks walk to the rear of the truck to ensure that the tailgate, safety device, or safety strap is in place and that all passengers are seated. It further states that drivers must "refuse to move a motor vehicle in which anyone is in an unsafe position."

Another type of driver error, which fortunately happens less often but can result in multiple injuries when it does happen, is that of transporting more than the authorized capacity of passengers in the cargo bed. TB ORD-639 states that the authorized passenger capacity (not including operating crew) in an M35 2 1/2-ton truck is 14; in an M54 5-ton truck it is 16. Troop seat kits for CUCV (M1008) and HMMWV troop carriers (M998 and M1038) are for eight personnel.

Safe operation of cargo trucks requires knowing and following all applicable rules.

### **References**

- . AR 385-55: Prevention of Motor Vehicle Accidents
- . TB ORD-639: Passenger-Carrying Capacity of Tactical and Administrative Vehicles Commonly Used to Transport Personnel
- . FM 21-305: Manual for the Wheeled Vehicle Operator

## Driver Training

A soldier who had said he felt uncomfortable driving an M51A2 dump truck was told to drive it anyway. Approaching a highway T intersection, he became distracted trying to shift gears, and the truck rolled through the stop sign onto the highway. It was struck by a tractor-trailer coming from the right, and both drivers and the dump truck's assistant driver were killed.

An NCO who had said he did not fully understand the operation of the M916 truck drove it anyway to transport a D-7E bulldozer. When the brakes lost air pressure on a downgrade, the NCO lost control of the truck. He jumped or was thrown out, sustaining fatal injuries.

All too often people assume that driving an AMV is no big deal, that anyone can do it, no matter what sort of training a driver has or hasn't received. Such an assumption is not only false, it's dangerous. About 70 percent of all AMV accidents involve driver error.

Operating tactical vehicles calls for special skills well beyond those needed for commercial sedans and pickups. That means training; there's no getting around it--no substitute, no shortcut.

Accident investigations have shown that the SF 46 (U.S. Government Motor Vehicle Operator's Identification Card) is sometimes issued in a hurry, and drivers are assigned with little attention paid to the need for training. But sooner or later a cost is exacted for skimping on driver training, and that cost may be the highest--soldiers' lives.

The revised AR 600-55: Driver Selection, Training, Testing, and Licensing is out now. Driver training requirements have been strengthened because quality training is so important in preventing AMV accidents. The AR provides for driver training in the Active Army to be conducted at battalion level.

The Army Transportation School has produced FC 55-32: Driver Selection, Training, Testing, and Licensing in Units--Tactical Wheeled Vehicle Operator, which should be a basic item in every battalion or Reserve component driver training program. Request copies from your MACOM, ATTN: Publications Control Officer.

Most of the information in FC 55-32 applies to training for all tactical wheeled vehicles, but some vehicle-specific guidance is included. Until comprehensive vehicle-specific training materials are available for every vehicle, trainers will have to supplement the FC with unit-developed training in the unique handling characteristics of each vehicle for which the applicant is to be licensed.

Programs of instruction should identify tasks, conditions, and standards that apply to the unit's mission and equipment. Training should include preventive maintenance checks and services (PMCS); unique problems of the vehicle; handling peculiarities; emergency procedures; backing; and ground guides.

If drivers will be required to pull trailers at any time--and most will, sooner or later--they will need additional training, and it needs to be annotated on the SF 46. For example, driving a 2 1/2-ton truck by itself is one thing; add a trailer, and a whole different set of principles applies. It's harder to maintain control with a trailer attached, and turning corners and backing are especially tricky--they must be practiced.

The revised AR 600-55 allows commanders to waive the requirement for an SF 46 for personnel who have a valid State driver's license and will operate only administrative-type commercial vehicles. However, to operate any tactical vehicle, including the CUCV, and all vehicles over 10,000 pounds gross vehicle weight, vehicle-specific training is required.

Qualifications for a State driver's license have little relation to the task of driving a CUCV in 4-wheel drive or a tactical 2 1/2-ton truck cross-country at night in blackout drive, with a cargo bed full of troops, or maybe pulling a trailer. The vehicles' size and shape are different, different mechanical operations are involved, and, especially, the mission is most often an Army-unique one.

The battalion commander should look at the driver training program to ensure it is a quality program and is functioning as intended. Is the program run by highly capable, experienced personnel? Are driver candidates thoroughly trained in the specifics of each vehicle they will drive? Is the training followed by a road test that demonstrates the driver trainee's ability to handle the vehicle in a variety of situations (not "once around the motor pool")?

Every unit depends heavily on its drivers day in and day out. Without their skill and dependability, the unit would be virtually shut down. The temporary loss of even one driver, passenger, or vehicle because of an accident can be a severe hindrance. Too many such losses might have been avoided if the drivers' units had invested the time and resources to build a strong driver training program.

## **AMV Operations in Confined Areas**

What do field operations, motor pools, maintenance facilities, supply storage areas, and built-up areas have in common? They all offer vehicle operators the opportunity to use all their skills in operating their equipment. However, along with this opportunity goes responsibility to use extreme caution.

Operating vehicles in confined areas poses unusual problems in that maneuvering space is condensed. Operators must make more turns, back up more often, use their brakes more frequently, and do all this with more going on around them. They must have ground guides, good visual references, and a working knowledge of the equipment they are operating.

There are times when an operator will just take a vehicle for a short spin around the motor pool area. This often results in damage to equipment and personal injury. The operator usually will not use ground guides or perform PMCS because there seems no reason to, not just to move the vehicle a short distance. But when a vehicle starts to move, especially in a confined area, the potential for an accident starts to happen.

Field operations invite other dangers. Operators can be tired, in a hurry to prove they can accomplish the mission, or nervous about their ability to perform with unfamiliar equipment or in an unfamiliar environment. Any of these conditions set the stage for human error. For example, a 1/4-ton-truck driver is tasked by his squad leader to park a 5-ton cargo truck. The soldier, knowing that both vehicles have four-speed manual transmissions and that he only has to move it a short distance, accepts the task. When he starts the vehicle, he hears a buzzer. Not knowing that it's a brake warning, he ignores the buzzer and proceeds to move the truck. When he sees two soldiers with their backs to him in his immediate path, he applies the brakes with no result. The truck hits both soldiers and a tree all because he was not familiar with the equipment.

Operators should ask themselves the following questions before operating their equipment or vehicles in confined areas:

- . If I fail to perform PMCS and the brakes fail, who is at fault?
- . If I back over a sleeping soldier, who is at fault?
- . If a soldier riding on the tailgate of my vehicle falls off and is killed, who is to blame?
- . Have I made all the safety checks and done all I can do to prevent an accident from happening?

Any operator who can answer yes to the last question need not worry about the answer to the others.

## **Winch Cables Devour Fingers**

In the last 3 years, at least 34 soldiers and Army civilian employees have had fingers or thumbs cut or crushed by winch cables. Eleven of the injuries were serious enough to be classified as permanent partial disabilities. This dismal record suggests that some personnel are not receiving enough safety awareness training before they get involved in winch operations.

As the 34 victims found out, winching-or performing maintenance on winches-can be downright dangerous. Given half a chance, winch cables will devour fingers. In 32 of the cases, that chance was presented when the victim's glove, rag, or bare hand was caught on the cable and pulled into the winch. Some extracts:

- . Employee's glove was pulled into winch by frayed cable.
- . After recovering an M1 tank, soldier was helping to rewind winch cable. He did not let go as cable approached rollers on trailer, and it pulled his thumb through the rollers.
- . Employee reached for winch cable while it was operating and got his right hand caught in front winch.
- . Due to inadequate communication (a problem cited in eight reports), winch cable was engaged while soldier still had his fingers between winch cable and winch drum.

If possible, winches should be fully rewound with a load or deadfall attached. Otherwise, personnel should follow instructions in the applicable operator's manual for rewinding the winch without a load.

Section V of FM 20-22: Vehicle Recovery Operations is devoted to safety precautions, one of which states: "Make every effort to stand clear of any wire rope under tension. When wire rope is drawn taut and then released suddenly by a break, its recoil (or backlash) will cut a person in two. A winch line under load stretches like a rubber band and stores up a lot of energy. In fact, a steel winch cable weighing 50 to 500 pounds has a better spring than rubber. A broken winch cable snapping back could be compared with a rifle bullet except the bullet makes a fairly clean hole and the winch cable makes a messy wound. Treat a wire rope under stress with the same respect you would a loaded gun." In short, stay alert.

Another precaution: "Personnel handling wire ropes should wear heavy leather-palmed gloves to prevent hand injuries or cuts from broken wires. Never allow a moving cable to slide through the

## **Drug Use and the Army Motor Vehicle Driver**

The operation of Army motor vehicles requires that drivers be in total control, both mentally and physically. Soldiers using drugs can be a danger to themselves, their fellow soldiers, and their equipment. Even drugs issued by medical facilities can degrade reasoning abilities, blur vision, cause drowsiness, and alter motor reflexes. These altered states could cause accidents. For example:

A soldier returning to the rear area for supplies lost control of his vehicle on a curve and drove into a tree. There were no skid marks to show he tried to avoid the accident. Although the soldier was only slightly injured, the vehicle was a total loss. Earlier that morning, the soldier had reported to sick call and was given a decongestant for his cold.

A soldier was en route to turn in his vehicle when he blacked out. His vehicle hit a street sign, a fence, a fire hydrant, and two parked cars. The soldier was taking prescribed medication.

Drugs issued through military medical facilities carry side effects warning labels that may state, "Do not operate equipment; use may cause drowsiness." Users should read and comply with these warnings.

Soldiers who report to sick call have a responsibility to understand what is being prescribed for them and the effects it may have on their assigned duties. They should inform their first-line supervisors of the restrictions that the prescribed drug places on them. First-line supervisors should take these restrictions seriously and never overrule limitations or allow the user to operate equipment.

While prescribed drugs can cause problems, nonprescription drug use is more difficult to control because the supervisor has no sick-call book to check. Users may not notify their supervisor that they're taking over-the-counter drugs, even those that carry warnings, because they don't notice any effects. However, notification of nonprescription over-the-counter drug use is the responsibility of the soldier.

Illegal drugs are a totally different matter. The pusher places no warning labels on the drugs, and users are not going to notify their supervisors. Supervisors can only rely on their past experience and knowledge of their soldiers.

While extra training, reprimands, and UCMJ punishment are corrective measures after the fact, the best countermeasure against drug-related accidents is well-informed soldiers and vigilant first-line supervisors.

## **Ground Guides--A Safety Essential**

Most soldiers realize they need to use a ground guide--some of the time--for both wheeled and track vehicle operations. A look at the accident reports received at the Army Safety Center sadly indicates that ground guides should be used much more often than they are.

General guidance is that ground guides are required anytime a large vehicle or track enters an area where other vehicles and personnel are stopped to link-up, preparing a bivouac, and bivouacking in an assembly area. A ground guide is used in a cantonment area when a large vehicle or track is being moved within close confines of other personnel or equipment. Track vehicles are always guided in a cantonment or motor pool area.

### **Wheeled vehicles**

It's not just tracked vehicles that need to use ground guides. FM 21-305 places the responsibility for using ground guides and for passenger safety squarely on the driver of the wheeled vehicle. He is to see that all passengers are on board and that restraint systems are secured. It is his responsibility to see that the load, whether human or material, is secure before moving the vehicle. He is also required to ensure that he can maneuver his vehicle safely.

The driver of the 5-ton truck was being ground guided into an assembly area. The one ground guide was positioned to the left front of the vehicle to guide the vehicle from the narrow, dry dirt road to the parking area about 50 meters down the road on the right. To

avoid a tractor coming from the opposite direction, the driver moved to the right side of the roadway. The dirt embankment gave way under the right wheels and the driver reacted by turning the wheels to the left and accelerating. The 5-ton truck turned on its side. It was late in the day and only one ground guide was guiding the truck forward and from his position he could not judge how far right the truck had moved. A second ground guide positioned to the right rear of the truck could have prevented the truck from getting too close to the edge of the embankment.

One ground guide can be used for moving a vehicle forward but two or more ground guides should be used (at least one front and one rear) to ensure the driver can see the primary ground guide in front and the other ground guide or guides can see all other areas around the vehicle. Large vehicles with cargoes may require three or more guides.

The sergeant was moving a 5-ton dump truck. His passenger tried to act as ground guide while sitting in the passenger seat. They hit an APC.

Drivers are told (FM 55-30) never to move vehicles without first checking on both sides, front and rear to ensure they can maneuver without endangering personnel or equipment. A guide should always be posted when maneuvering and backing a vehicle in a motor pool or bivouac area, especially at night and in many instances under blackout conditions. AR 385-55 says ground guides will be in view of the driver at all times, but it really doesn't mean in the passenger seat. If ground guides are not available, the driver will dismount and check clearance before backing. The purpose of a ground guide is to move a vehicle safely--both for the well-being of the people on board and for the vehicle.

### **Drivers**

Drivers and ground guides must work as a team. It is the driver's responsibility to:

- . Request a ground guide when any doubt exists about safely moving a vehicle.
- . Always use a ground guide or guides in bivouac, assembly, or maintenance areas or moving through dismounted troops.
- . Check completely around your vehicle before starting it or have your ground guide check.
- . Use ground guides before and during any backing operations. Smaller vehicles, under 2 1/2 tons that have good clearance, may be backed without a guide if you are sure you are clear. It pays to get out and check behind you.
- . Always use a ground guide when traveling cross-country during periods of reduced visibility if the tactical or training situation permits.
- . When using a guide, always follow his directions. If you are unsure of his intent, stop the vehicle immediately and wait until you understand his directions.
- . Keep about 10 yards between you and the guide. Be sure you are far enough behind him to be able to stop safely should he stumble or fall.
- . If the guide goes out of your sight, stop at once. If you are following a guide at night, stop when you no longer see the light he is using to guide you.
- . Do not take signals from more than one guide. If you are backing up, the guide to your front may need help from the guide at the rear. If so, the front guide should relay signals to you.
- . The assistance of a guide is especially important when backing into a highway.
- . Good judgment is needed to maneuver a track vehicle across a narrow bridge or through a narrow passage. If any doubt exists, request a ground guide. This applies to large wheeled vehicles as well.
- . During night operations a crewman at the rear of each vehicle with a handheld flashlight with red lens cover can prevent rear-end accidents.
- . Talk with your ground guide. You must make sure the ground guide knows the capabilities of your vehicle and knows how to serve as a ground guide.
- . Drivers have a responsibility for the safety of the ground guides. Make sure the guides are not working in the path of the vehicle and that they are not between the vehicle and an object.

### **Ground guides**

Ground guides are responsible for seeing that a wheeled or track vehicle does not injure anyone and that the vehicle sustains no damage while maneuvering.

- . Know all visual signals. Use standard Army signals.
  - . Be familiar with the vehicle you are guiding and know its capabilities and limitations.
  - . Check on both sides, front and rear before moving a vehicle. Ensure the vehicle can be maneuvered without endangering personnel or equipment.
  - . Remain clear of the vehicle path and be visible to the driver at all times.
  - . Never place yourself between two vehicles or between a vehicle and an object.
  - . Stay outside the path of the vehicle and at least 10 yards in front of the vehicle.
  - . If two or more guides are used, know who the primary ground guide is and pass all information through the primary. Make sure there is communication between guides.
- Ground guides have a responsibility for the safety of the driver and passengers of a vehicle and for the equipment. They must make sure that no person is in the path of the vehicle and that they guide the vehicle correctly on firm maneuver ground.
- Ground guides are a safety essential. But to be of value, they must be knowledgeable. Their own life and the lives of their fellow soldiers can depend on their knowing the characteristics and limitations of the vehicle they are ground guiding as well as how to ground guide.

## **Prevent AMV Driver Error Accidents**

Troops, weapons, and supplies have to be moved safely and efficiently for the Army to accomplish its mission.

Motor vehicle drivers are the link between mission objectives and the material the Army must have to do the job. However, lives and equipment lost in motor vehicle accidents break the link and seriously hamper the Army's ability to perform its mission.

Army accident records show that AMV accidents usually have more than one cause, but driver error is involved in almost 7 out of 10 accidents.

Army vehicles are built to operate over all kinds of terrain under all types of conditions. But even the best vehicles in the world soon become useless if driven unsafely or maintained improperly.

AMV drivers are professionals with the required specialized knowledge and training. As such, they must strive to eliminate driver errors.

Following basic driving principles and techniques is one way for drivers to do their jobs right, especially from the standpoint of Army safety requirements. Five areas need to be reviewed, reemphasized, and constantly kept before drivers:

- . Vehicle maintenance
- . Defensive driving
- . Backing
- . Off-post operations
- . Weather

### **Vehicle maintenance**

AMV drivers are required to do a daily maintenance inspection of their assigned vehicles. During this inspection, they should find mechanical defects (e.g., loose battery connections, broken wiper blades, broken speedometers); they should check for leaks, body damage, proper lubrication; and they should assure all components and attachments are secure. A preoperation inspection includes checking engine oil, coolant, hydraulic fluid, tire pressure, and instruments and gauges. Also, every tool must be properly secured and stored. A post-operation inspection similar to the preoperation inspection should be made.

### **Defensive driving**

Defensive driving begins with the driver's attitude. The attitude of a professional is one of individual responsibility for the vehicle, the lives of passengers, the cargo, and the driver's own life.

Before starting a vehicle, the professional driver adjusts the seat and mirrors and clears the vehicle--checks the sides, rear, and front for any obstruction. The professional driver always fastens the safety belt if the vehicle is equipped with them.

Speed is the major cause of driver error accidents. Posted speed limits are only one factor when determining correct speed. Existing road conditions, weather conditions, type of vehicle being driven, area of terrain, sight distance, speed of other vehicles, driver's physical condition, and stopping distance must all be considered to correctly determine proper speed.

Maintaining control of the vehicle is a prerequisite of defensive driving. Control depends on the vehicle's speed and the driver's steering ability. Drivers must slow before entering curves; stay on their side of the road, and maintain safe following distance.

Turning at intersections requires the defensive driver to signal intent to turn, slow down, check for vehicle clearance, and swing wide but not across centerline or stop lines on near side

of turn. Operators of trucks, especially those with trailers, should make intersection turns with extreme caution.

### **Backing**

Backing, even when done at slow speed, is more dangerous than going forward. All vehicles 2 1/2 tons or larger, vans, and all trucks with trailers are required to use ground guides during backing operations. When a ground guide isn't available, the professional driver gets out and sees whether the rearward patch is clear. Even after such a check, backing must be done with extreme caution. As a rule, do not back long distances unless it is absolutely necessary. It is usually safer to turn around and cover the distance going forward.

### **Off-post operations**

Most Army tactical vehicles, because of their design, are required by regulation to travel at a speed slower than the posted maximum. Professional drivers are aware of this and maintain proper speed.

Following too closely, particularly in convoys, is a dangerous practice. An adequate following distance is one in which the driver can stop safely if the vehicle in front of him should suddenly apply brakes. Under normal driving conditions on an open highway, the safe following distance for trucks, tractor and semi-trailer combinations, or similar type vehicles, is 300 feet in the daytime and 500 feet at night. However, during bad weather and other poor driving conditions, following distances should be increased to allow for the driver's lack of visibility or other hazards.

### **Weather**

The first drops of rain are danger signals that tell drivers to use extra caution. Rain reduces visibility, loosens grease and grime that form slippery surfaces, increases braking distances, and induces hydroplaning.

Snow and ice reduce tire traction even more than wet pavements. When vehicles are driven on packed snow or ice, they should be equipped with snow tires or chains. It is essential to reduce speed and maintain control to keep from skidding when trying to stop or turn. Bad weather conditions demand the professional driver think ahead.

Driver errors cause accidents, kill soldiers, and destroy vital combat equipment. They don't have to happen. Following basic driving principles and techniques can prevent driver error accidents.

## **Drivers, Train Them And Win**

If Army drivers are not properly trained, we don't win the next war! Year in and year out, analysis of accident data points out inadequate driver training as a major cause of AMV accidents. Soldiers continue to be injured and killed because the Army fails to train them in how to drive an Army vehicle safely in all of the conditions that the vehicle can be expected to operate. Yes, these soldiers knew how to drive in the civilian world and were probably fairly good drivers, as long as they were on controlled, well-paved, and properly marked highways. Yes, these drivers received their initial training in their AIT phase and arrived at their units with a learner's permit; and, of course, the chain of command immediately identified these individuals as school-trained drivers.

Wrong! These soldiers are as inexperienced in the handling of an Army vehicle as they were when they first found out that Dad's car could get them places a lot faster than their bicycle.

What has happened, and become a matter of course, is a young hard-charging soldier, right out of AIT, is assigned his first Army vehicle and told to "get it ready."

First mistake! The supervisor or section leader assumes his new driver is up to par on every aspect of his vehicle; why of course, he's school trained. Wrong again!

Sure, he's had some school training, but in the basics only, and with limited exposure to every phase of his vehicle's capabilities. What he needs now is to come under a well-structured,

well-defined set of standards that he must meet before he can become the driver of that sophisticated piece of equipment. That's where that training officer or battalion S3 comes in and identifies and requires such a program.

Too often the unit commander is told "train your drivers, but do it during motor stables." Wrong again!

Yes, hold that unit commander's feet to the fire and make him allocate time and resources toward getting his drivers trained, but have S3 set up a comprehensive driver training program, identify very specific tasks, conditions, and standards that suit your mission and equipment. Cover every facet from proper maintenance procedures, driving in all types of weather over all types of terrain, towing procedures, and especially emergency procedures peculiar to that vehicle.

The Army has manuals on all types of driver training with some good information in them. There is now one manual that offers a concise, well-thought-out sequence of training along with excellent examples of a viable training program that can be conducted at the battalion or squadron level. That manual is FM 21-17, Driver Selection, Training and Supervision, Track Combat Vehicles. FM 21-305, Manual for the Wheeled Vehicle Driver, offers the same basic information. By combining the format from FM 21-17 with that of FM 21-305, a viable training program for wheeled vehicle drivers can be developed.

The wheeled vehicle drivers' program becomes critical when you realize that within most combat units the wheeled vehicle drivers are not school trained and are actually working in their secondary skill.

All this sounds good so far, but it still has to be implemented, carried out, and most important, tested and followed up.

A battalion level driver training section is a good way to carry out such a plan. S3, gather your senior experience in the unit and develop a challenging program that gives driver training the importance it justly deserves.

Identify time, training areas, and specific levels of accomplishment before a soldier is issued a driver's license. Give this program the highest visibility and develop it into a major training objective. Recognize these individuals by developing a driver's award within the battalion to signify their importance to the team effort. These drivers will be handling highly sophisticated and expensive equipment that will require a much higher degree of teaching than has been administered in the past.

For too long, the Army driver has been left to his own resources and has managed to do a good job, but given that extra measure of specialized training, that extra recognition of this additional skill, and the confidence that he is well-trained in all phases of combat driving will do more for this Army's combat readiness posture than any other endeavor.

It's time to put the emphasis on drivers' training and regard these soldiers as being the key to the successful deployment of our units in combat. Let's raise the standards of training and enforce those standards to what you would want them to be if your life depended on it--because it does!

## **Towing Is Hazardous**

Towing with trailers or disabled vehicles and the associated activities of connecting and disconnecting are common day-to-day Army operations. Unfortunately, injuries and property damage involving towing operations are also rather common.

The potential for an accident, always present in vehicle operations, is significantly increased when towing is involved. The presence of the towed load magnifies all the difficulties encountered during driving, especially in emergency situations.

### **Driving with trailers**

FM 55-30: Army Motor Transport Units and Operations states in chapter 9: "Operators will be tested on appropriate truck-trailer or truck-tractor semitrailer combinations when required to tow trailers. The operator must complete the prescribed training and tests and must qualify in accordance with the pertinent regulations. Qualification to tow trailers will be so noted on both DA Form 348 and SF 46."

Accident reports indicate that some drivers are being assigned to towing missions with inadequate training or, in some cases, no training at all. This lack of adequate training is costing dearly in personnel time lost and equipment downtime. Some FY 91 examples:

The soldier was driving an M35A2 2 1/2-ton truck towing an M103A3 mobile kitchen trailer. He was driving too fast and lost control of the truck. The truck and trailer left the road, and the trailer rolled onto its side, resulting in total destruction of the \$12,365 mobile kitchen.

Keeping speed down is critical. This is the first principle all towing training must emphasize. Operating a single vehicle, it is sometimes possible to regain control after losing it, but with a trailer in tow, forget it! The operator never really had control over that piece of equipment anyway, except insofar as it would tend to follow its leader as long as they were moving at a relatively slow, even speed.

The generator set and several cans of fuel were in a trailer being towed by a 5-ton truck. One of the fuel cans came loose from its mount and fell over, leaking fuel into the bed of the trailer. The generator then began to crank spontaneously due to an electrical

short. The electrical short ignited the spilled fuel, and the overturned fuel can exploded, followed shortly by explosion of the other fuel cans on the trailer. Total damage cost was \$1,500.

Follow prescribed procedures carefully. Towing provides enough hazards in and of itself, without the dangers added by failure to follow procedures. Operators must be sure fuel cans and other cargo are properly secured. Doing it right is always the safest and most efficient way.

### **Towing with wrecker or towbar**

As stated in FM 21-305: Manual for the Wheeled Vehicle Operator, when towing a vehicle, proceed slowly at 5 to 10 mph because the towed vehicle will skid on turns at higher speeds. In addition, drivers need to know the towing capacity of the equipment they are using.

The soldier was towing one M936 5-ton wrecker with another. The towbar broke because the weight of an empty M936 exceeds the wrecker's maximum towing capacity. The towed vehicle, held only by the safety chain, began to veer back and forth and struck a light pole, causing \$900 damage.

### **Towing with field expedients (cables)**

The soldier was tasked to recover a disabled M109 shop van. He used an M813 5-ton truck for the mission but failed to use a towbar. As a result, when the truck stopped, the shop van ran into its rear, causing \$1,150 damage.

The 5- to 10-mph speed prescribed in FM 21-305 for towing vehicles is especially crucial when a towbar is not being used. In addition, make sure there is a driver in every towed vehicle unless it is being towed by a wrecker.

### **Connecting and disconnecting**

If the hazards of over-the-road towing would make a long list, so would problems occurring during the connecting and disconnecting process. Accident reports are filed on a regular basis on personnel who have had a hand, foot, or leg injured while hooking up or detaching a trailer. Some recent examples:

Two soldiers unhooked a full water trailer from the back of a 2 1/2-ton truck without first lowering the front support leg. When the tow pintle of the trailer cleared the hitch on the truck, the trailer crashed to the ground. The tow pintle landed on one soldier's foot, breaking two toes.

The NCO was assisting other soldiers in hooking up a generator trailer to an M813A1 truck. While the vehicle was being backed up to the trailer, the NCO noticed that the towing pintle was closed and reached to open it. His hand was crushed between the two pieces of equipment.

Towing connection and disconnection requires training and supervision--and some common sense. Just as drivers must have special training for towing, participants in the hookup process need to be taught how to do it right. Learning by trial and error is far too painful.

Severe, and sometimes fatal, injuries occur when personnel position themselves between the towing vehicle and the towed vehicle or trailer:

Three soldiers were assigned to disconnect a 2 1/2-ton truck from the recovery wrecker. When the wrecker assistant driver set the parking brake, he failed to set enough tension, and, for a chock, he used a rock not large enough for the job. One soldier stepped between the two vehicles to lift the towbar. As the wrecker driver pulled his vehicle forward, the towbar was released and the 2 1/2-ton truck rolled forward, pinning the soldier against the wrecker and causing a pelvic fracture.

Three soldiers were trying to remove a towbar connecting two 5-ton trucks. The vehicles were positioned on a 2-degree grade, which wedged the towbar, making it difficult to remove from the towing vehicle. The bar was removed from the right side of the towed vehicle, after which the towing vehicle was backed to allow play in the left side. The pintle bar was then released and the towbar disconnected. The towed vehicle began to roll forward, and two of the soldiers attempted to stop it by hand. It kept rolling. One soldier jumped out of the way,

warning the other to jump also. The other soldier did not move fast enough and was fatally crushed between the two vehicles.

There are four rules for connecting or disconnecting a towbar:

1. Perform the operation on as level a surface as possible.
2. Be sure the disabled vehicle's parking brake is fully set and operative.
3. Chock the disabled vehicle's wheels with real chock blocks.
4. Stay out from between the two vehicles as much as possible.

Except when there is a good reason why these rules cannot be followed, they should all be followed every time. Additional guidance on towbar safety can be found in applicable vehicle operator's manuals and in TM 9-4910-593-12&P: Operator's and Organizational Maintenance Manual for Towbar, Motor Vehicle.

## **Trailer Towing Preparation and Procedures**

The top five causes for trailer - towing accidents are:

1. No PMCS before use.
2. Failure to secure loads.
3. Overloading.
4. Excessive speed for conditions.
5. No ground guides or improper use of ground guides.

In some cases, several of these factors combined to cause an accident. For example--

. After completing a field training exercise, two NCOs were told to recover and wash a D8K dozer. They selected an M123A1C tractor with an M870 trailer attached for the mission without performing PMCS or getting the vehicle dispatched. If they had completed PMCS, they would have discovered that the trailer had no brakes. All went well until the return trip with the load. While traveling down a 5-percent grade, the driver allowed the vehicle to exceed safe speed, and he lost control and wrecked. The driver was killed, and his assistant driver was hospitalized for 8 weeks.

The accident investigation determined that the NCOs had violated several important procedures that resulted in the tragedy:

- . No PMCS was conducted.
- . The vehicle was not dispatched.
- . The trailer was overloaded by 4,500 pounds.
- . The driver exceeded the speed limit and maximum rpm recommended for the vehicle.
- . The load was not secured properly on the trailer.

This accident, which involved four of the top five accident causes, could have been prevented if procedures had been followed.

FM 55-30: Army Motor Transport Units and Operations, appendix I, gives a good and simple checklist for inspection of trailers. In addition, each trailer TM outlines specific procedures. Chapter 10 of FM 55-30 also gives detailed instructions on how to secure cargo. Following is a summary of these instructions:

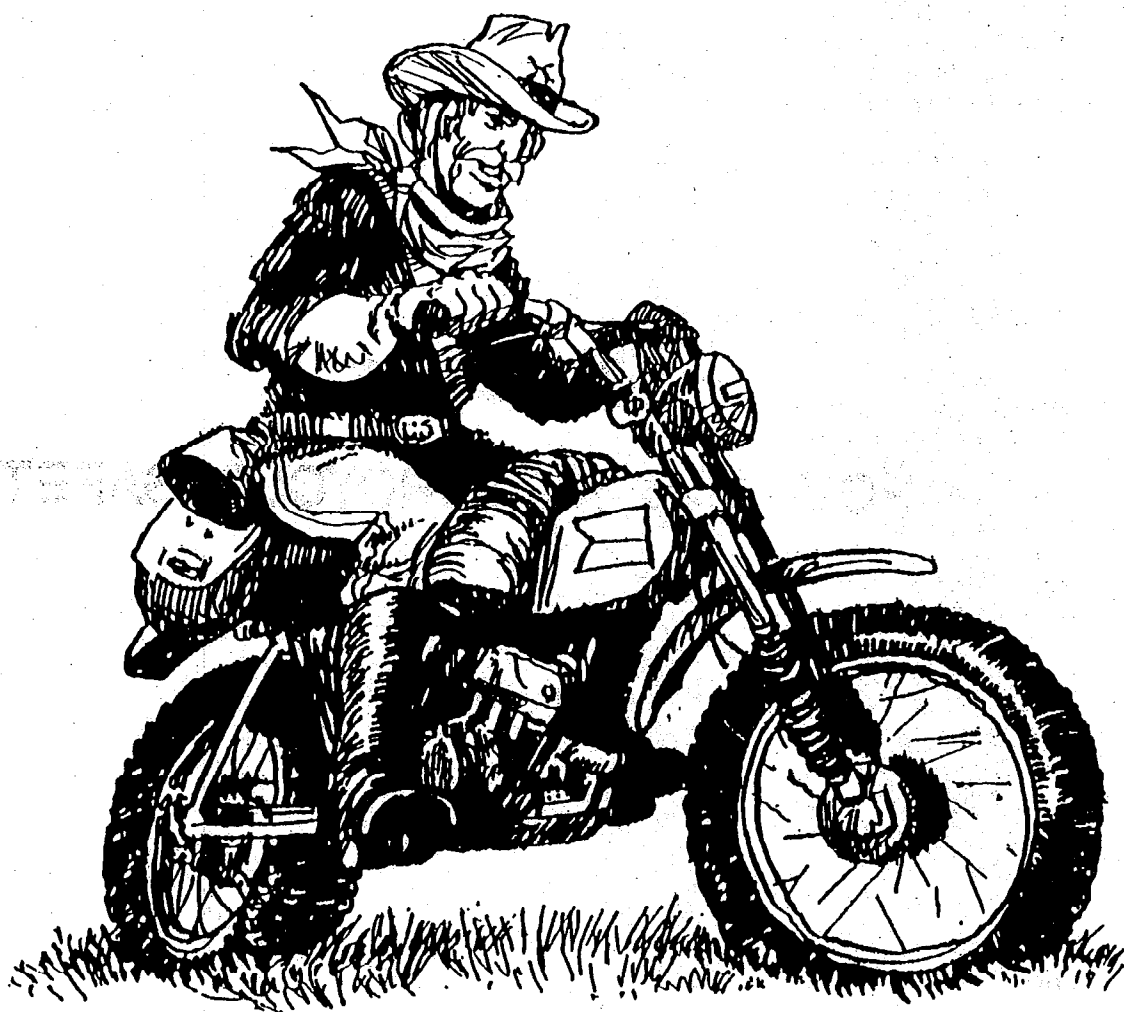
The vehicle driver is responsible for ensuring that the load on his vehicle is safe. While the shipper normally loads the cargo, the driver must ensure it is loaded properly. The driver must know--

- . How much weight his vehicle can carry.
- . How much weight can be put on each axle.
- . Where the center of gravity is for different loads.
- . Payload capacity.
- . How to distribute loads on vehicles.
- . How to secure the load.

See FM 55-30 for further information.

# **CHAPTER 6**

## **POV AND MOTORCYCLE SAFETY**



## POV accidents—the Army's biggest killer

Year after year, accidents in privately owned vehicles take more soldiers' lives than all other Army accident activities. In fact, a soldier is killed every 33 hours and another is injured every 5 hours in POV accidents. Most POV accidents, injuries, and deaths involve at least one of the following dangerous behaviors.

- \* Drinking and driving
- \* Speeding
- \* Not using seatbelts
- \* Fatigue

### Drinking and Driving:

\* Not everyone heeds the message that drinking and driving are out. TV and radio commercials, billboards, and magazines are telling the nation that the tolerant attitude toward drinking and driving is a thing of the past. States have raised the drinking age to 21 and have beefed-up enforcement laws. Stiff penalties are mandatory in most states. The Army's crackdown on drinking and driving parallels and mandates an immediate, automatic 1-year suspension of on-post driving privileges for refusing to take a blood-alcohol test when apprehended for DUI.

A letter of reprimand signed by a general officer will be placed in the records of soldiers convicted of drunk driving on or off post, and of soldiers who refuse to take a blood-alcohol test. No promotion board, local or HQDA, will look with favor on soldiers who have such a letter in their files. Anyone caught driving on post while their driving privileges are suspended or revoked, will lose post driving privileges for 5 years.

### Speed:

\* Army accident records show that in most fatal auto accidents the driver is speeding. This includes not only exceeding the posted speed limit, but also driving too fast for road and weather conditions. The posted speed isn't necessarily the safe speed. Road and weather, time of day, and the amount and type of traffic all have an effect on safe speed. Slower speeds give drivers more time to react, and the lower the speed, the lower the crash forces in case a crash can't be avoided.

#### Seatbelts not used:

\* Too often, soldiers and their families die because they do not wear seatbelts. The myths they use as excuses for not wearing seatbelts are just that - myths. At least half of the soldiers killed in car wrecks last year would still be alive today if they had used their safety belts. More people are killed from being thrown around inside the car or being thrown out from the crash. In fact, the chances of being killed are 30 times greater if a person is thrown out of the car. Accident records show that soldiers wearing safety belts are 70 percent less likely to be killed or seriously hurt than unbelted drivers. Shoulder-lap-belt combinations reduce the chance of injury up to 90 percent.

#### Fatigue:

\* Fatigue is a dangerous adversary. Many soldiers try to overcome it by ignoring it, by pushing themselves just a little farther. This overconfidence is the crack that allows fatigue to let the head nod, to close the eyes for a second, just long enough to cause an accident. Fatigued drivers are dangerous drivers.

#### POV Accident Prevention:

\* Information and education programs are the heart of POV accident prevention. Interest, accountability, and direction are vital elements. You, not the other guy, must set the example as well as instruct your fellow soldiers on POV accident countermeasures.

# Drunk Driving Accident Prevention Ideas

The following is a listing of good ideas that may assist in unit drunk driving prevention programs.

- A new twist on the designated driver idea—use the buddy system for planned festivities. The designated driver signs a "Friends don't let friends drive drunk" card and his buddy signs a "no hassle" pledge to give up his car keys when his buddy says he's had too much.

- Require unit soldiers going on leave to sign no-drunk-driving contracts. They promise that they'll make alternative transportation arrangements before attending a function where alcohol will be served.

- Distribute red ribbons to all soldiers and have them tie the ribbons on their car keys. This serves as a reminder not to drink and drive.

- Hold a contest for the "most fun" or "most entertaining" non-alcoholic unit holiday festivities to de-glamorize alcohol and promote the idea that real soldiers don't have to drink to have fun.

- Provide breathalyzer tests on-site with no

UCMJ action as an educational and awareness tool to prevent accidents.

- Demonstrate leader concern for off-duty safety by having officers and NCOs visit community hot spots—places known to be frequented by their soldiers.

- Conduct a mock memorial service before the holiday leave period emphasizing that festivities should be memorable, NOT memorial.

- Have soldiers sign and carry pledge cards promising to call unit leaders when they have had too much to drink. Some leaders attach quarters to these cards for the phone calls.

- With assistance from Alcohol and Drug personnel, train supervisors to spot the early warning signs of potential drug/alcohol abusers.

- Coordinate with club managers to serve "designated drivers" free non-alcoholic beverages all evening. Designated driver buttons should be distributed as drivers come through the door.

- Initiate a trip plan review for soldiers planning holiday travel. ■

## Drink Chart Number of Drinks in One Hour Approximate Blood Alcohol Content (BAC)

DRINKS		Body Weight by Pounds								STATUS
		100	120	140	160	180	200	220	240	
One Drink- 1 oz. of 100 proof liquor, or 12 oz. beer, or 4 oz. fortified table wine.	1	.04	.03	.03	.02	.02	.02	.02	.02	RISKY
	2	.08	.06	.05	.05	.04	.04	.03	.03	
	3	.11	.09	.08	.07	.06	.06	.05	.05	IMPAIRED
	4	.15	.12	.11	.09	.08	.08	.07	.06	
	5	.19	.16	.13	.12	.11	.09	.09	.08	
	6	.23	.19	.16	.14	.13	.11	.10	.09	
	7	.26	.22	.19	.16	.15	.13	.12	.11	ILLEGAL
	8	.30	.25	.21	.19	.17	.15	.14	.13	
	9	.34	.28	.24	.21	.19	.17	.15	.14	
	10	.38	.31	.27	.23	.21	.19	.17	.16	

Alcohol leaves the body at approximately 3/4 oz. per hour. The illegal BAC in most states is 0.10.

## DUI is risky business

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**T**he three biggest risks of driving under the influence are—

**Risk of an accident.** You already know that your safety and the safety of others is at stake if you drink and drive. By .04 percent BAC, you have increased the driving risk. By .10 percent BAC, legally DUI in all states, your chances of an accident are at least six times greater than when sober.

**Risk of an arrest.** Police officers realize the seriousness of drinking and driving and enforce-

ment has changed greatly. Considerable effort is being made to keep drunk drivers off the road. Arrests for DUI have doubled during the past five years. The drinking driver is being treated as a major highway safety problem.

**Risk of inconvenience.** Driving a car makes things convenient. If you lose your license due to DUI, activities that were possible may be out of your reach. In some cases, having a driver's license is a necessity for employment. Losing your license may result in losing your livelihood. ■

## Alcohol and behavior

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**W**hen alcohol reaches the brain it affects the way people behave. The effects are present with one drink. When the drinker has trouble talking or walking, it is not because the muscles controlling speech and movement are impaired, but because the control center—the brain—is affected. The first area of the brain affected controls social inhibitions and other things that we learn. Eventually, alcohol affects all behaviors and body processes.

Here's how the amount of alcohol consumed in one hour will affect the average 160- to 180-pound person:

**One beer (BAC .01-.02 percent).** Inhibitions are lessened; judgment begins to be affected.

**Two beers (BAC .03-.04 percent).** Reaction time is slower; drinker appears relaxed

and friendly.

**Three beers (BAC .05-.06 percent).** Judgment is not sound; reasoning less reliable. Drinker will not be thinking clearly and may do or say things that are rude and unreasonable.

**Four beers (BAC .08-.09 percent).** Hearing, speech, vision, and balance are affected.

**Five beers (BAC .10-.11 percent.)** Most behaviors are affected: Body parts seem to not work together; performing any task with hands is difficult; walking without stumbling is difficult.

If drinking continues until BAC reaches about .30 percent—about 11 beers—a coma or deep sleep is not unusual. If BAC reaches .50 percent, a deep coma and death can occur. ■

# Pre-Trip Safety Checklist

**T**his checklist is designed to assist commanders and other leaders in briefing personnel before departure for PCS, TDY, or holiday leave.

Date of session: \_\_\_\_\_

Name/Rank: \_\_\_\_\_

Destination: \_\_\_\_\_ Estimated miles: \_\_\_\_\_

Date of departure: \_\_\_\_\_ Return: \_\_\_\_\_

Anticipated weather conditions: \_\_\_\_\_

**1. Is the vehicle in safe operating condition?**

Tires	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Brakes	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Engine	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Lights	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Fluid levels	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Battery	Yes <input type="checkbox"/>	No <input type="checkbox"/>
First aid kit	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Other		

**2. Are departure and arrival times appropriate to preclude speeding, fatigue, unexpected delays, bad weather?** Yes ☐ No ☐

**3. Are travel routes planned in advance?** Yes ☐ No ☐

<b>4. Is the driver prepared for emergencies?</b>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Extra money/major credit card	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Emergency road service contract	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Blankets	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Cold weather gear	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Extra food/water	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Tire chains	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Shovel/sand for added traction on snow/ice	Yes <input type="checkbox"/>	No <input type="checkbox"/>

**5. Is there someone the driver can call and check with periodically on departure and return? (This helps to ensure rest stops are taken and that help will be on the way in case of an emergency.)** Yes ☐ No ☐

**6. Does the planned trip include time for meals and rest stops? (Drivers should plan for at least a ten-minute rest stop every two hours.)** Yes ☐ No ☐

**7. Is the number of hours allotted sufficient for mileage? (The Army permits 350 miles per day for PCS or TDY travel. Off-duty drivers should plan on no more than 8 hours on the road per day.)** Yes ☐ No ☐

**8. Has the driver been informed that safe driving takes precedence over all travel schedules?** Yes ☐ No ☐

**9. Does the driver know that safety belt use is mandatory?** Yes ☐ No ☐

**10. Has the driver been advised of the consequences of drinking and driving?** Yes ☐ No ☐

**11. Has the driver been informed of the procedures to follow to avoid hurrying in case of an emergency or unscheduled delay? (It's better to return late than not at all.)** Yes ☐ No ☐

# What's available and how to get it

**T**he following is a list of films and videos on drinking and driving. These films are available through your local training and audiovisual library or TASC.

**How Much is Too Much? 707516DA, TVT 20-6375, 11 minutes.** A doctor talks about the effect of alcohol on the decision-making process and visually demonstrates how much alcohol it takes to adversely affect the ability of most people to drive.

**DUI—Don't Drive, 707517DA, TVT 20-6376, 15 minutes.** Nine soldiers volunteer to participate in a DUI test program. Each is trained by Texas State Troopers to drive a precision driving course. The participants then are asked to consume measured amounts of alcohol in a party setting and then drive the course again. Post-test interviews reveal the participants' perceptions of their ability to drive under the influence of alcohol.

**The \$7,000 Drink, 706303DA, TVT 20-6373, 19 minutes.** Two soldiers talk about (and visually recreate) the personal, professional, and financial impact of receiving a traffic ticket for driving while intoxicated.

**Consequences, 706304DA, TVT 20-6374, 18 minutes.** A young soldier goes to a promotion party, drinks too much, and is involved in a traffic accident in which his close friend is killed. The story shows the personal, professional, and legal (civil and UCMJ) consequences experienced by all involved.

**Social Drinking—Fun and Fatal, 69343DA, MF 20-5999, 13 minutes.** This film shows how beer and other alcoholic drinks impair judgment, slow reflexes, and reduce vision enough to make the difference between safe driving and accidents.

**Driving and Drinking, 102434DA, 25 minutes, 16 mm only.** How alcohol physically affects the human body, how it affects driving, the magnitude of drinking and driving problems, and how the driver can minimize the probability of a drinking and driving accident.

**The Party's Over, 50434, AFIF 393, 20 minutes.** Based on a true incident, this film portrays a father's grief resulting from a drunk driving accident. Before going home to his son's Halloween party, he stopped after work to have a few beers. Those few beers turned into too many, and then he decided to drive home. The Halloween party was over and, unfortunately, the father never saw his son, who was waiting for him in the driveway.

**Under the Influence, 406024DD, AFIF 294, 28 minutes.** Thirty volunteers, all with above average tolerance to alcohol, participated in this motion picture on the effects of social drinking on everyday driving skills. This police-supervised experiment shows the participants driving a special test course sober and then driving the same course after drinking enough liquor to bring their blood-alcohol content up to .10. The volunteers were not professional drivers and came from a broad cross-section of society, all from different age, ethnic, financial, and occupational groups. The experiment shows that they all have one thing in common—they can't drive safely after drinking alcohol.

**The Uniform Code of Military Justice, Part II, 701609DA, TVT 27-6338, 35 minutes.** A newspaper editor orders a story follow-up because he questions the justice involved in a soldier's death. Of the three men implicated, one was imprisoned, one was given extra duty as punishment, and the other got off free. This film explains trial by court martial procedures, representation by a military defense counsel, and the differences in civilian and military prosecution. ■

## TWO-WHEELED DEATHS MOUNT CAUSES REMAIN THE SAME

The reasons for motorcycle deaths remain the same year after year; alcohol, inexperience, excessive speed, and failure to wear a helmet.

### Alcohol:

\* Drinking before riding a motorcycle is a big risk. Many bikers believe they can have a few drinks without affecting their riding skills. But even at moderately low levels, alcohol can affect alertness, vision, coordination, and ability to react skills that are critical to safe motorcycling.

### Inexperience:

\* Most motorcyclists are self-taught, or learn from a family member or friend. They do not learn accident-avoidance skills such as proper braking and countersteering.

Cyclists involved in accidents have an average of 1.9 seconds to complete their accident-avoidance maneuver once they recognize the danger. Good scanning techniques give cyclists more time to recognize danger, react to it, and make the right evasive move.

Rider training courses are the quickest and easiest way for cyclists to gain experience. These courses teach riding skills, and accident-avoidance techniques. They equip the rider with knowledge to defend himself from many of the roads dangers.

### Excessive speed:

\* Speeding, according to the Motorcycle Safety Foundation, is the motorcyclist's most common traffic violation. It is a violation that can lead to death. Cyclists are bound by the same traffic laws as cars and trucks. Additionally, weather and road conditions are critical in determining a motorcycle's safe speed.

### Protective gear:

\* The most important article of protective gear is the helmet. Although even the best helmet available cannot guarantee survival in all crashes, not wearing a helmet triples the probability of a serious head injury in a motorcycle accident. Wearing a helmet along with other protective gear can reduce the severity of injuries by nearly half.

In addition to impact protection, helmets also reduce wind blast that can cause hearing difficulties, squinting or tearing. They should be securely fastened, fitting the head snugly, and providing maximum peripheral vision. Helmets that meet Snell Memorial Foundation, Department of Transportation (DOT), or American Standards Institute requirements, offer the most protection. The DOT standard applies in most states.

Either goggles or a face shield can provide vital eye protection. A face shield should be securely fastened to the helmet, shatterproof, and free from distortion. Goggles, too, must be securely fastened to the helmet. The Vehicle Equipment Safety Commission (VESC) has established standards for goggles and face shields. Motorcyclists should look for the VESC seal when they buy a face shield.

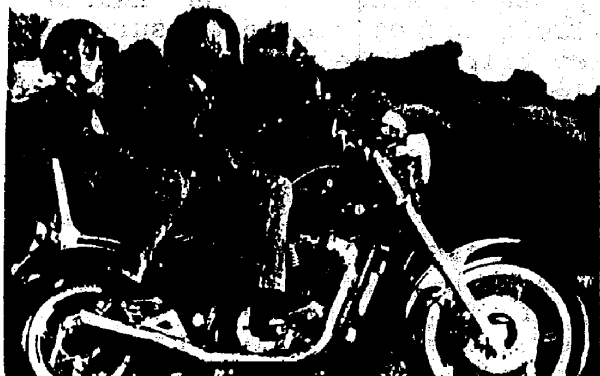
A heavy jacket, gloves, pants, and boots reduce most common abrasions. Lightweight leather gloves protect cyclists' hands and improve their grip. Heavy or bulky gloves reduce their ability to operate the hand controls. Boots with heels, heavy soles, and reinforced toes offer good protection. Motorcyclists can be more visible to others by wearing bright yellow or orange jackets or vests. Reflective tape on helmets and clothing helps them to be seen at night.

Motorcycle riding requires both skill and knowledge of special techniques and conditions vital to safe motorcycle operation. Rider training taken before licensing and in-traffic motorcycle use, could benefit both soldiers and the Army in helping to reduce accidents.

## Motorcycle regulation reminder

**A**R 385-55 makes it clear that all soldiers and civilians working on Army installations have no choice to make about motorcycle or moped safety. It requires the following:

- Drivers will satisfactorily complete an Army motorcycle safety course.
- Headlights must be on at all times.
- Two rearview mirrors are required, one on each side.
- Riders will not use headphones or ear-



phones while driving.

- Riders will wear an approved and properly fastened helmet. The helmet will meet Department of Transportation (DOT) construction standards.

- Riders will wear proper protective equipment. This includes eye protection such as clear goggles or a face shield attached to the helmet (a windshield or fairing is *not* eye protection). Riders will also wear full-fingered gloves, long trousers, long-sleeved shirts or jackets, high-visibility garments (bright colored for day, reflective for night), and leather boots or over-the-ankle shoes.

Soldiers must comply with these requirements at all times, on or off duty, on or off post; civilians will comply with the regulation while on post or while on government business on or off the installation. The regulation covers government-owned motorcycles and mopeds as well as privately owned ones. ■

# Reconstruction of a crash

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**T**his is the slow-motion, split second reconstruction of what happens when an unbelted driver crashes into a solid, immovable tree at 55 mph.

*One-tenth of a second.* The front bumper and chrome "frosting" of the grillwork collapse. Slivers of steel penetrate the tree to a depth of 1½ inches or more.

*Two-tenths of a second.* The hood crumbles as it rises, smashing into the windshield. Spinning rear wheels leave the ground. The front fenders come into contact with the tree, forcing the rear parts out over the front door. The heavy structural members of the car begin to act as a brake on the terrific forward momentum of the 2½-ton car. But the driver's body continues to move forward at the vehicle's original speed—20 times the normal force of gravity; his body weighs approximately 3,200 pounds. His legs, ramrod straight, snap at the knee joints.

*Three-tenths of a second.* The driver's body is now off the seat, torso upright, broken knees pressing against the dashboard. The plastic and steel frame of the steering wheel begins to bend under his terrible death grip. His head is now near the sun visor, his chest above the steering column.

*Four-tenths of a second.* The car's front 24 inches have been demolished, but the rear end is still traveling at an estimated speed of 35 mph. The body of the driver is still traveling 55 mph. The rear end of the car, like a bucking horse, rises high enough to scrape bark off low branches.

*Five-tenths of a second.* The driver's near-frozen hands bend the steering column into an almost vertical position. The force of gravity crushes his chest against the steering wheel, rupturing arteries. Blood spurts into his lungs.

*Six-tenths of a second.* The driver's feet are ripped from his shoes. The brake pedal shears off at the floor boards. The chassis bends in the middle, shearing body bolts. The driver's head smashes into the windshield. The rear of the car begins its downward fall, spinning wheels digging into the ground.

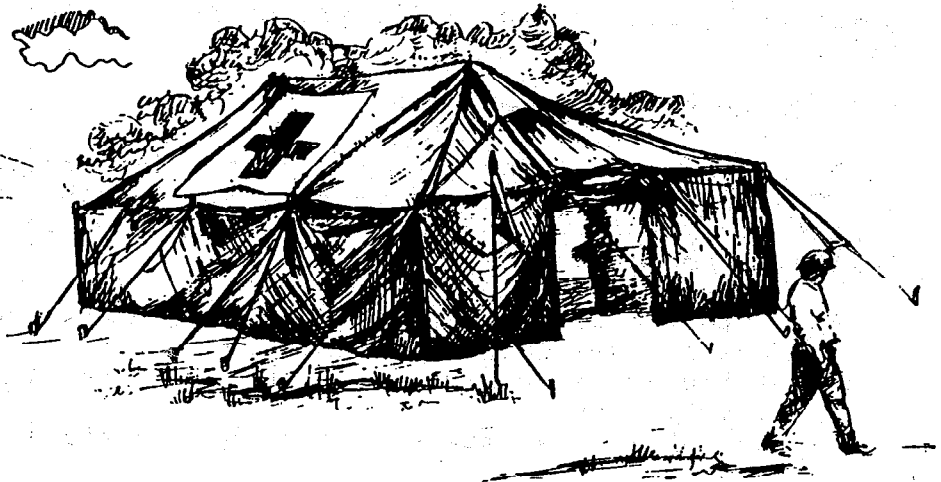
*Seven-tenths of a second.* The entire writhing body of the car is forced out of shape. Hinges tear, doors spring open. In one last convulsion, the seat rams forward, pinning the driver against the cruel steel of the steering shaft. Blood leaps from his mouth; shock has frozen his heart. The driver is now dead.

*Elapsed time: only seven-tenths of a second.*

**At least it's not a long time to suffer.**

# **CHAPTER 7**

## **FIELD SAFETY**



## Space Heater Hazards

Review of 136 recent accidents involving space heaters (M1941 type I, solid fuel, NSN 4520-00-257-4877; M1941 type II, solid fuel or liquid fuel, NSN 4520-00-927-4214; and M1950, yukon, solid or liquid fuel, NSN 4520-00-287-3353) identified three major causes, all of which are predictable and preventable:

Unlicensed operators  
Failure to follow procedures  
Inadequate preventive maintenance

### Unlicensed Operators

AR 600-55, chapter 6, paragraph 6-1, requires that space-heater operators be licensed. Mistakes by untrained, unlicensed operators are a major cause of space-heater accidents. Common mistakes include the following:

- \* Pouring fuel directly into burners before operation. The resulting buildup and vapor concentration can cause an explosion.
- \* Turning the carburetor up too high. This causes the space heater to overheat.
- \* Improper reassembly of the space heater after cleaning. This mistake can allow fuel leaks which too often cause fires.

Commanders should ensure that all personnel who operate space heaters are trained IAW AR 600-55. They should prohibit unlicensed personnel from operating or performing maintenance on any space heater.

### Failure to Follow Procedures

Accidents resulting from operators' failure to follow procedures in TM 10-4500-200-13 are responsible for the majority of space heater accidents. Using by-the-book procedures would prevent the following common mistakes:

- \* Using gasoline as a starter fluid with wood or coal in space heaters designed for solid fuel.
- \* Allowing excessive fuel buildup in the heater before lighting it.
- \* Relighting a space heater that is still hot from previous use.
- \* Using the wrong type of fuel or mixing different types of fuel (for example, diesel and gasoline).
- \* Improper lighting for example, standing over the heater and lighting fuel through the top opening instead of using a wick through the access port at the base.

Commanders and supervisors should enforce procedures, safety precautions, and warnings in the TM.

## **Inadequate Preventive Maintenance**

Space-heater accidents that occur due to lack of maintenance and cleaning of equipment are the direct result of inadequate supervision at the first-line supervisor level. The primary causes of these accidents are:

- \* Leaking fuel lines caused by cracks or cross-threaded brass fittings.
- \* Faulty carburetors that leak or cannot be adjusted.

First-line supervisors should ensure that soldiers inspect, test, and perform space-heater maintenance on a regular basis, not just when the unit goes to the field. They should also require soldiers to completely clean operating space heaters daily and follow up by inspection.

## Cold Weather Injuries

Cold injuries are winter's greatest danger. Soldiers in combat units suffer more cold injuries than those in combat support and combat service units.

A soldier is more likely to be injured if he is often in contact with the ground or if he is immobile for long periods - such as when riding in a crowded APC. He is vulnerable if he stands in water in a foxhole, if he is kept out in the cold for days without warming, and if he lacks the chance to attend to his personal hygiene. His vulnerability goes up with fear, fatigue, dehydration, and poor nutrition.

People who have suffered a cold injury have a higher-than-normal risk of suffering another. They are unlikely to be injured in the same location on their body, but their overall susceptibility is higher.

Cold injuries are preventable, and prevention is a command responsibility. Soldiers must be taught how to protect themselves against cold injuries.

### Frostbite

Frostbite is the most common cold injury. It occurs at temperatures of freezing and below. The most vulnerable parts of the body are the face, fingers and toes.

The first sign of frostbite is usually an uncomfortable feeling of coldness followed by numbness. There may be a tingling, stinging, or aching feeling - even a cramping pain. The skin of the affected area turns red at first, and later becomes pale gray or waxy white.

Immediate action can stop frostbite. If the cheeks are frostbitten, cover them with warm hands until the pain returns. Place frostbitten fingers, uncovered, under the armpit or on the belly, next to the skin. Place bare, frostbitten feet against the belly of a companion, under the clothing.

It's easier to prevent frostbite than to cure it. Wearing a properly fitting uniform, keeping socks and clothing dry, and protecting oneself from the chilling effects of wind can prevent frostbite. Routine exercise of the face, fingers, and toes keeps them warm. Use the buddy system, pair soldiers off so they can watch each other for signs of frostbite.

Remember, frostbite hurts, and when skin starts to thaw, it hurts some more.

## Trenchfoot

The feet seem to be especially susceptible to cold injury. Feet perspire more and are generally less well ventilated than other parts of the body. They need special care to keep them warm and dry.

Trenchfoot is a cold injury resulting from a cold, damp environment. It has a combination of causes, including legs and feet maintained in one position too long, prolonged standing in water, or having wet feet for hours while the temperature is just above freezing.

In the early stages of trenchfoot, the feet and toes are pale, numb, and stiff. Walking becomes difficult. In later stages, the feet and toes become red, swollen, and warm. In cases of extreme injury, the flesh dies, and amputation may become necessary.

The best way to prevent trenchfoot is to keep the feet dry and warm. Every soldier should have extra socks in his possession so that he can change socks at least twice daily. Whenever feet get wet, they should be dried as soon as possible and dry socks put on. Each time he changes his socks, the soldier should massage his feet. Also, he should wipe the inside of his boots as dry as possible.

Tight boots or socks should be avoided as they restrict blood circulation and make the feet feel cold and can lead to freezing. For the same reasons, avoid lacing footgear tightly.

Exercise the feet. Stamping the feet, double-timing a few steps back and forth, and flexing and wiggling the toes inside the boots all require muscular action, produce heat, and help keep feet warm.

Trenchfoot is a cold weather injury that can disable a soldier, but it can be prevented.

## Fatigue

Tired soldiers have a greater chance of cold injury because they tend to forget to do the things that keep them warm. Both mental and physical weariness contributes to apathy, which leads to cold injuries. To fight fatigue, soldiers must make the hours of sleep count by -

- o Putting as much insulation under their sleeping bags as possible.
- o Sleeping in as little clothing as possible and never in wet clothing.
- o Never sleeping with their boots on.
- o Taking a piece of candy into their sleeping bag so, if they wake up cold, they can produce heat by eating the snack.
- o Keeping their bags dry.

## Protective clothing

Properly wearing cold weather clothing goes a long way toward preventing cold injuries. Army cold weather gear is designed on the layer principle; loose clothing worn in layers gives maximum insulating airspace to retain body heat. And ventilation, the process of cooling off slowly, is much easier when loose, layered garments can be removed one at a time.

Hands should be well protected. A good rule for soldiers to follow is to never use bare hands if the job can be done wearing gloves, and never use gloves if it can be done wearing mittens. The blood supply to the fingers runs up one side of the fingers to touch and help heat each other.

An uncovered head and neck lose heat up to 10 times faster than any other area of the body. The pile cap conserves heat and protects the ears. A scarf gives added protection against the cold.

The feet are the hardest part of the body to keep warm and dry. Combat boots and buckle overshoes provide good protection, but it takes more than that. Leaders must inspect personnel to ensure socks are changed regularly and proper foot care is practiced.

## Cold Weather Threats - Hypothermia and Dehydration

Hypothermia and dehydration are twin threats in cold weather operations. Many leaders and soldiers who are quick to recognize symptoms of frostbite do not know much about hypothermia or cold weather dehydration. They do not consider themselves potential victims because they are prepared for the cold. But even soldiers prepared for cold can fall victim to hypothermia or dehydration.

### Hypothermia

Hypothermia describes the rapid, progressive mental and physical collapse that accompanies chilling of the vital organs. It is caused by exposure to any combination of cold, wetness, and wind and is aggravated by exhaustion.

Hypothermia is the lowering of the body core temperature (temperature of the vital organs; heart, lung, brain, etc.) To function properly, the body core temperature must be 98.6° F. A shift of half a degree can cause illness, fever, or chills. Shifts of 5 degrees in either direction can cause life-threatening problems.

Victims of hypothermia will be aware of feeling cold. Some may realize they are becoming clumsy, but most will not be aware of what is happening to them. As skin temperature drops, sense of touch and pain decreases; muscles and their motor nerves are weakened. Shivering produces heat, but it also consumes energy. If it is intense and prolonged, it can result in exhaustion. Continued heat loss produces violent and uncontrollable shivering, speaking difficulty, sluggish thinking, and amnesia. Advanced heat loss results in muscular rigidity, erratic heartbeat and labored breathing, unconsciousness, and finally, death.

Leaders should watch soldiers for these symptoms:

- o Uncontrollable fits of shivering.
- o Slurred or vague, slow speech.
- o Incoherence, lapses in memory.
- o Immobile, fumbling hands.
- o Frequent stumbling or lurching gait.
- o Drowsiness.
- o Apparent exhaustion, inability to sit up after a rest.

The conscious, shivering victim is considered to be only mildly hypothermic; he retains the ability to rewarm himself when removed from the chilling environment. It is the mildly hypothermic soldier that leaders can help. To rewarm the mildly hypothermic victim -

- o Remove him from the cold environment.
- o Cover him with blankets and other warming and insulating materials.
- o Apply moderate heat to the whole body (from a room heater or warm shower).

- o Give him warm fluids, but avoid caffeine, which narrows the blood vessels.

- o Use a sparsely clothed person wrapped in a blanket or sleeping bag with the victim to increase the victim's body temperature.

Protective clothing is a soldier's best defense against hypothermia. Standard military cold weather clothing works well if it is used properly.

### Dehydration

Water requirements for heavily loaded, properly clothed soldiers can approach a gallon a day in cold weather. Insensible water loss (sweat absorbed by clothing), obvious sweating, and increased urination all affect water requirements.

A soldier can easily follow his state of hydration by checking the "snow spots". Deep yellow, orange, or brown urine indicates the need for more water. Other signs of dehydration are slow motion, no appetite, nausea, sleepiness, and a higher than normal temperature. This will be followed by dizziness, a dry mouth, tingling in the arms, and an inability to walk.

It is important to note that the symptoms of severe dehydration are similar to those of hypothermia. To distinguish between the two, open the victim's clothing and feel the belly wall. If the belly is cold, the victim is probably hypothermic; if it's warm, he is probably dehydrated. However, this test is not foolproof because cold weather dehydration can also lead to total body cooling.

Keep the dehydrated victim warm, but loosen his clothes so circulation is not restricted. Gradually feed him warm liquids. Don't let him eat snow, which uses up body heat. The victim needs plenty of rest. Get him to medical personnel as soon as possible.

## MOPP in the Cold

Mission-oriented protective posture (MOPP) gear is used by soldiers around the world to protect themselves against nuclear, biological, and chemical (NBC) contamination.

The overgarment of the MOPP gear consists of an outer layer of nylon-cotton and an inner layer of charcoal-impregnated polyurethane foam. It is designed to "breathe" and to allow for escape of a certain amount of heat and moisture, but heat buildup can still be a problem.

### Heat stress

Commanders expect and are on the alert for heat problems when soldiers wear MOPP gear in hot climates. They know that the effort a soldier expends and the speed at which he works, along with the temperature and humidity, determine the chance of his overheating. They monitor their soldiers closely in moderate and hot climates to prevent heat stress.

It is just as critical that commanders and small-unit leaders monitor MOPP-clad soldiers in cold weather. Soldiers wearing MOPP gear in cold weather environments are also susceptible to overheating and excess perspiration, especially when they expend a lot of effort. The solution to overheating and excess sweating is prevention.

Commanders need a thorough understanding of the MOPP system's flexibility. MOPP levels are modified based on the commander's assessment of the situation and criticality of the mission. This flexible system allows commanders to relax some of the standards to lessen heat. For example, a commander may allow soldiers to loosen the neck cord, undo the hood to form a partial vent, or unzip the jacket to the neck in order to vent. This stovepipe or chimney effect allows heat to escape and lowers the body core temperature, reducing sweating, heat stress, and the possibility of cold injuries.

### Cold injuries

In cold weather, the potential for a cold injury exists alongside the potential for heat stress. When overheating and excess perspiration occur, soldiers should be allowed a rest period before making a MOPP gear exchange. Even with a rest period, perspiration can collect inside the facepiece and cause a cold injury. Soldiers should take care when removing the mask to prevent perspiration from freezing on their faces. A cloth such as an extra glove, sock, or handkerchief can be used to wipe the face and inside the mask immediately after removing the mask. Arctic troops are issued the balaclava, a combination knit ski mask and ski cap, which they use to dry their faces immediately after the mask and hood are taken off. Troops in other cold regions might use the all-purpose wool scarf as a towel. But it must be used quickly to prevent the possibility of a cold injury.

Putting on a protective mask that is cold may cause some discomfort and difficulty in getting a tight seal. Wearing the mask carrier beneath outer garments allows a soldier's body heat to keep the mask flexible, but this lengthens masking time.

When fitting the mask, soldiers must adjust the head harness only tight enough to create a good seal. If the mask is too tight, it will restrict blood flow to certain areas of the face and make those areas more susceptible to cold injury.

The metal buckles on the protective mask become cold quickly; however, if the mask is worn properly, the metal buckles should have little or no contact with the skin. These metal buckles should not be wrapped with tape. Doing so could interfere with proper adjustment and fit of the mask and lead to problems in properly clearing and sealing the mask. Soldiers, however, should place a small piece of tape over the exposed metal rivets inside the facepiece to prevent cold injury. The tape should be just large enough to cover the metal and not so large that it interferes with putting on the mask.

Hands are susceptible to cold weather injuries while wearing the chemical protective gloves. One way of combating this is to wear the green wool liners from the black shell gloves instead of the white glove liners underneath the protective gloves. Soldiers may wear standard work gloves or black shells over the butyl-rubber gloves to protect them from damage or during cold weather. Also, the mittens issued as part of the cold weather gear are large enough to be worn over the rubber gloves and provide protection against the cold.

Wearing the protective mask and hood doesn't give the ears much protection from the cold. Some soldiers in the Arctic wear the balaclava in order to have a layer of insulation between the hood and the skin. Troops not having the balaclava might consider using the sleeping cap issued with the cold weather sleeping bag. The cold weather parka is issued to all units operating in cold climates. It is large enough to be worn over the MOPP jacket, and its hood is large enough to fit over the head, the mask with hood, and the helmet with liner. This could afford protection for the head and ears against extreme cold. Use of the pile cap is not a practical solution because it is difficult to wear either inside or outside the hood.

These are only interim solutions. A permanent solution is needed, and one is expected in the near future. Natick Research and Development Center is looking at attaching a hood, made of the same material, to the overgarment.

#### **POL operation in MOPP**

Water and POL product spills on the chemical protective clothing can be a problem even at moderate temperatures. Spillage in cold weather presents the potential for cold injury, even hypothermia in dire instances. If the butyl-rubber apron is available in the supply system, wearing it could be a solution to the problem. Currently under development is an item specifically for decontamination operations. It is an expendable, lightweight, and inexpensive suit

called SCALP (Suit, Contamination Avoidance and Liquid Protection). The suit is designed to provide a barrier to liquid chemical agents and prevent wetting during decontamination operations when worn over the protective overgarments.

In an actual contaminated environment, the potential hazards of cold weather may not warrant a commander's full concern. But, in a training environment, safety should not be sacrificed for realism. Realism in training will not be lost by adjusting the MOPP level to prevent overheating, ensuring soldiers have a rest period before a MOPP exchange, or allowing cold weather gear to be worn over the chemical protective suit. Commanders should modify training if necessary during extreme conditions to provide safety and protection for their soldiers.

## TACTICAL SLEEP PROCEDURES

1. Commanders will establish and enforce a tactical sleep plan. The following procedures will apply.

- a. Ensure personnel are briefed and follow the unit sleep plan.
- b. Inspect and approve all sleeping locations selected by subordinate leaders.
- c. Designate and supervise where personnel are to sleep.
- d. Ensure sleeping positions are marked for high visibility and post alert guards around personnel in the sleeping areas.
- e. Ensure personnel never sleep in front of, behind, or under any vehicle.
- f. Ensure guards are briefed on their duties and responsibilities, and equipped with a red filtered flashlight. Guards must stop any vehicle attempting to enter the sleeping area.

2. Soldiers.

- a. Will not change sleeping locations without approval of supervisors and notification of the guards and leaders.
- b. Make an evaluation of their sleeping locations for possible hazards and ensure the area is clear of any dangers.
- c. Never turn on the power system of any vehicle until an all clear of personnel has been given, then start the vehicle.
- d. Never move a turret without warning all personnel.
- e. Check under and around a vehicle before moving the vehicle.
- f. Ensure all vehicles approaching within 20 meters of any vehicle or sleeping areas during limited visibility have a ground guide.

## Heat Injury is a Seasonal Danger

One of the most serious environmental problems this summer may well be the heat and humidity soldiers will have to endure. You can reduce the possibility of having a heat casualty if you understand the causes of heat injuries and take preventive measures.

Anyone who overexerts in hot humid weather, runs a risk of a heat related injury. When temperature and humidity are severe, work intensity and work-rest cycles should be adjusted.

The factors which cause soldiers to become heat casualties include high humidity, lack of heat acclimatization, excessive body weight, lack of sleep, fatigue, sunburn, absence of sweating, diarrhea, infection, fever, and excessive drinking of diuretics such as coffee or alcohol.

**Acclimatization.** Even young, physically fit soldiers can become heat casualties if they let pride, ambition, discipline, or athletics drive them to excess in the heat. Acclimatization requires living and working in heat for at least 8-14 days and requires doing progressively more difficult tasks. The amount of time needed depends on the individual soldier's condition. Acclimatization will disappear in a week or two once the soldier is out of the hot environment. Time spent in the hospital, on leave, or even working 2 weeks in an air conditioned office can undo a soldier's heat tolerance.

**Water consumption.** Soldiers cannot rely on thirst as an adequate indicator of how much water they need. The body's thirst mechanism urges a person to drink only one-half to two-thirds of one's actual water needs. Strength, endurance, and mental performance can be impaired after 2-3 hours of heavy sweating.

Soldiers must learn to drink water even when they are not thirsty. An effective rule of thumb is to have soldiers drink water until their stomachs begin to feel full and then to maintain that full feeling. Most soldiers judge the consumption of 6 to 12 ounces of water every 20 minutes (about one quart an hour) to be comfortable. Drinking up to 2 quarts of water per hour may be required in some high heat stress environments.

Caution soldiers against using beer as a fluid replacement. Experts agree alcohol is a known diuretic and can do harm if used to replenish lost body fluids. Drinks with either too much sugar, or too much salt, can't be absorbed by the body as rapidly as water. Water is the best weapon against summer's heat and humidity.

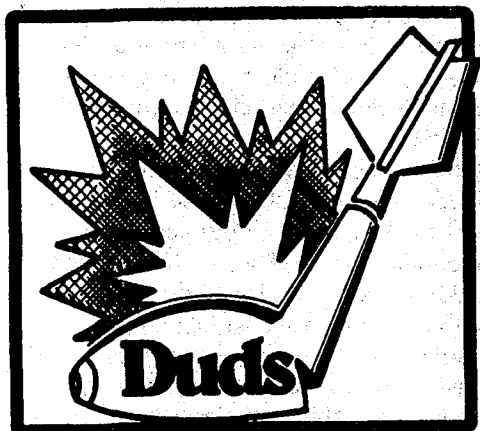
**Wet Bulb Globe Temperature (WBGT).** The WBGT index is the commander's best means of evaluating environmental heat. Your preventive medicine or environmental medicine section can tell you the WBGT. The WBGT index gives the air temperature, humidity, air movement, and radiant heat in one number. The conditions of the index range from white (76-78 degrees) to black (88 and above). If you are to be away from the installation, in the field, or at a training site, you can use a portable WBGT kit. The kit is listed on the Army Master Data File (AMDF) and basis of issue is CTA 8-100, Army Medical Department Expendable/Durable Items.

# CHAPTER 8

## EXPLOSIVES SAFETY



**THESE CAN KILL OR CRIPPLE YOU!**

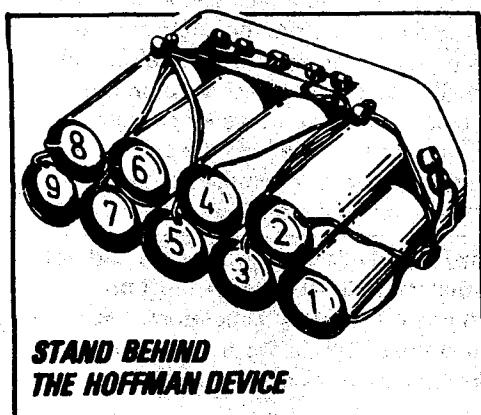


**Don't touch them!**

Contact: Local Police or Military Police

# Explosives Safety

## Pyrotechnic simulators



**STAND BEHIND  
THE HOFFMAN DEVICE**

Pyrotechnic simulator devices accounted for 192 of the 240 reported explosives accidents. Although simulators do not normally kill (1 death in 192 accidents), they do injure; that results in an expensive loss of manpower. More than 225 injuries resulted from the 192 accidents, and injury and damage costs totaled more than \$1.4 million. This cost will continue to rise as medical costs are ongoing for soldiers still undergoing treatment.

- **Hoffman device.** The most frequently occurring accident involving any single type explosives device is with the Hoffman. **More than half of all Hoffman accidents involve soldiers attempting to disassemble, cut open, modify, or hand ignite this device.** This simulator must be used only for its intended purpose and only in the way it was designed to be used. It is not suitable for modification for any other use. It doesn't make a good booby trap or any other modified device; it does make a good Hoffman device.

The Hoffman, the Atwess, and most other flash-type simulators contain a magnesium photoflash compound that is classified as a mass detonating explosive and detonates like TNT. It also burns much faster than gunpowder and generates extremely high temperatures. Soldiers should never cut open or otherwise tamper with simulator devices. Commanders must educate soldiers in proper handling and use of pyrotechnic devices to prevent the following types of accidents.

- When the Hoffman device failed to detonate, a soldier brought it inside the M113 in which he was riding. He failed to disconnect the charge from the battery. The Hoffman exploded inside the track, burning and cutting the soldier and putting him on limited duty for several days.

- Another soldier was extracting what he thought was gunpowder from a Hoffman charge when his platoon leader discovered him. The platoon leader took the Hoffman charge from the soldier and tried to remove the powder himself. He made a neat pile of powder on top of his track and bent over to light the pile with his cigarette lighter. The powder flared up, and the platoon leader received second- and third-degree burns to his face and left arm.



- While guarding the perimeter of a battalion maintenance collection point, a soldier attempted to rig an early warning trip wire with a Hoffman round. The soldier made a fuse from a spring and a bottle. While setting the trip wire, the soldier accidentally completed the circuit and discharged the round.

- The unit was being evaluated and had been briefed on the mission by the battalion commander, a lieutenant colonel. The S-3, a major, asked if the command had any simulators or pyrotechnics that could add noise or realism to their mission. They had only some smoke and simulator tank burst 50mm cartridges for Hoffman devices, but no actual Hoffmans. After much discussion, another major, the battalion XO, suggested the 50mm could be "hot wired" for firing without the Hoffman device. He had seen this done many times by both active and Reserve troops to detonate simulators.

It was agreed that unit personnel not familiar with this procedure would not be required to use the hot-wired explosives. Those who planned to do so were instructed to hook one simulator to one 20-foot section of wire. They were then briefed on some of the hazards: Static electricity can detonate charges hooked up in this manner; each simulator equals about a quarter of a stick of TNT; simulators should be detonated at least 20 feet from the tank.

One crew decided it would take too long to fire their simulators one at a time, so they modified the simulators into sets of four and placed them in front of the tank's position. No attack came, and three sets of simulators were detonated in place before moving from the position. The crew continued setting and moving the simulators until chow time. The tank commander pulled one of the sets up on the tank near his hatch and noticed that a wire had come loose from the set and one simulator had failed to detonate. He held the set in place on the box until the tank stopped and then he attempted to rewire the simulator. It exploded, injuring him and his crew-members.

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**It is a misconception that only junior enlisted personnel should not handle pyrotechnics. All personnel using these devices must be trained and briefed before using any pyrotechnic simulators. Never assume that, just because soldiers have been in the Army a long time, they have had experience with and know how to use all pyrotechnic devices.**

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- **ATWESS.** A soldier's curiosity led him to take apart an ATWESS device just to see what was in it. Wanting to see what would happen to the "little black cylinder," the soldier lit a match and dropped it in the cylinder. It ignited, severely burning his right hand and wrist.

- The loader on a TOW tracking exercise had been briefed before the exercise on loading, firing, unloading, and safety of the M22 ATWESS simulator cartridge. Even though the loader had been briefed not to stand behind the weapon, he had twice loaded the cartridge from behind and twice was reprimanded for doing so. He was twice shown the correct method of loading the M22 ATWESS from the side of the launch tube. On the third attempt, he again loaded from behind the launch tube. Before he could be stopped, he inserted the simulator and closed the breech. For unknown reasons, it fired with the loader still in the back blast area.

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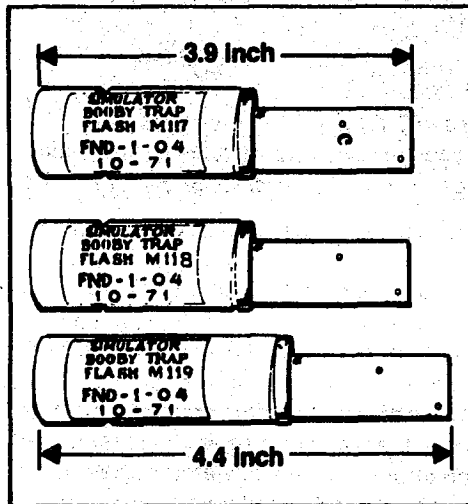
**There is no substitute for following correct procedures. Soldiers must be reminded constantly of the dangers of pyrotechnic devices, especially the hazards of unauthorized use.**

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They should be taught not to tamper or experiment with

pyrotechnics. Commanders should stress training so that all soldiers know how to use the Hoffman and the ATWESS properly. Safety briefings should include instructions and demonstrations on use of blanks and simulators, to include instructions on the dangerous features of the Hoffman and the ATWESS.

## Booby trap simulators



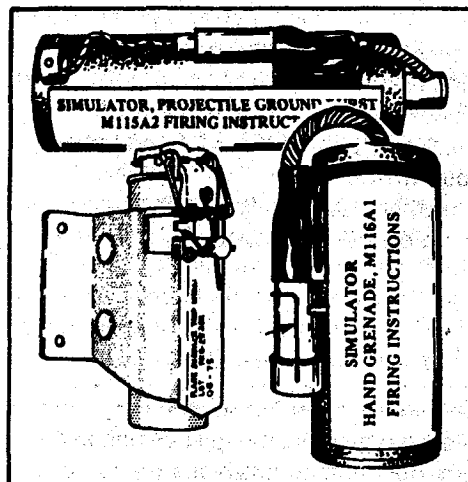
There are three basic booby trap simulators: the M117, M118, and M119. Each has a tubular body and a similar appearance. A soldier who is not **thoroughly** familiar with these devices can easily confuse them. Each type reacts differently when ignited, and a mistaken identity can cause serious injury. Ensure only trained, informed soldiers handle booby trap simulators.

- Supply failed to furnish instructions with the new box of M117 simulators, and the soldier paid no attention to the warning printed on the simulators. As a result, one of the simulators exploded in his hand.

- In the darkness, the squad leader failed to find out what type simulators he had just provided his soldiers. When one of the soldiers pulled the string, the flash simulator exploded in his hand.

- Upon mission completion, the battalion was moving back to base. A soldier was told to expend a box of pyrotechnics that would not be taken back. A captain identified them as whistlers, and the soldier detonated them by hand with no problems. The soldier accepted another box and, while expending the rounds, one of them exploded in his hand immediately after he pulled the string. This soldier received three lacerations and first- and second- degree burns to his right hand because the wrong kind of simulator got mixed in with a batch of whistlers and he failed to recognize the difference.

## Artillery simulators, grenade simulators, and trip flares

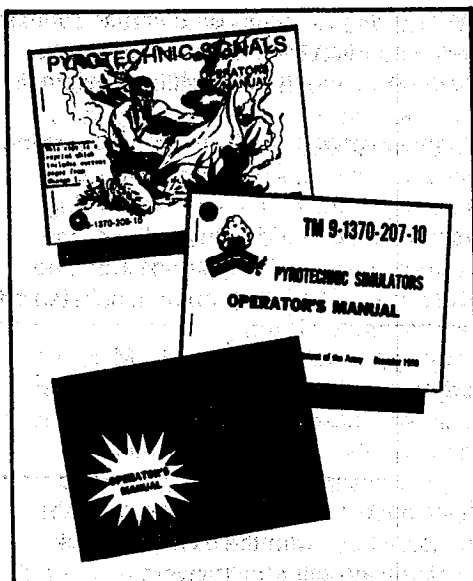


These devices are also involved in a large number of accidents, most of which are caused by tampering and throwing too close to personnel. Commanders must ensure that excessive motivation and aggressor play are controlled at all times. Positive inventory control can also reduce tampering and unauthorized use.

- **Artillery simulator.** After his truck ran over and broke open a simulator, a soldier threw his cigarette on the black powder spilling out. The flash fire burned his face and put him in the hospital.

- **Grenade simulator.** While on night patrol, soldiers fired blanks at another unit. A soldier from the unit under attack threw a grenade simulator at the opposing patrol. It exploded at the feet of another soldier who suffered a temporary loss of hearing and neck pain from the noise.

- **Trip flare simulator.** In direct violation of the UCMJ, a soldier had a trip flare simulator in his possession at a privately owned arcade. When he attempted to set it off, it exploded in his right hand. He was hospitalized for 8 days and on restricted duty for 30 additional days before facing a UCMJ action.



While on a field training exercise simulating artillery on a convoy, a soldier tried to set off several different simulators. None exploded. The soldier cut the casing on one simulator, spilled the powder onto the ground and lit it. The flash caused second-degree burns to his face and hands and put him in the hospital for 3 days.

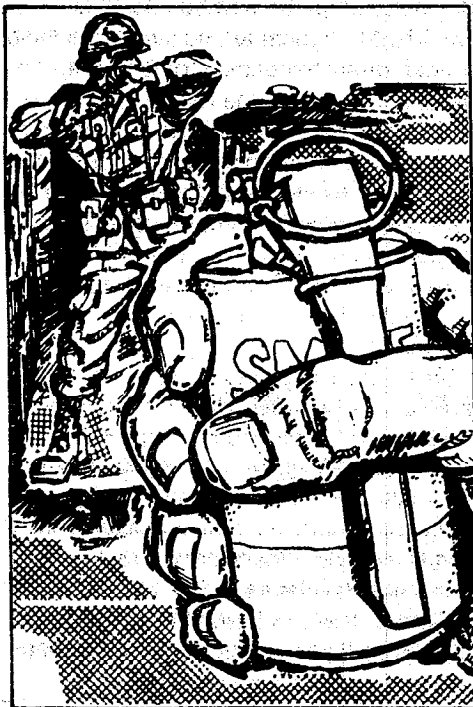
Four members of an aggressor fire team were in the woods approaching the tree line by twin lakes when one of the team members set off a trip flare at neck level. Gun powder from the blast irritated the cheek area under his right eye and caused irritation in his right ear as well as some hearing loss.

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**Trainers must be vigilant in teaching proper procedures and forceful in warning of possible dangers. The Army has prepared handy 4"x5" booklets for pyrotechnic simulators (TM 9-1370-207-10), pyrotechnic signals (TM 9-1370-206-10), and photoflash cartridges and surface flares (TM 9-1370-208-10) that fit easily into a field uniform pocket. Make sure each soldier who handles pyrotechnic simulators has read and knows these manuals. All briefings should include field safety procedures.**

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## Smoke



- Twenty-two soldiers on an air assault course were crossing through a low tunnel that had about 6 inches of water in it. When the primary instructor threw a smoke grenade inside the tunnel, the smoke, the confined space, and the water all combined to form a very dense stagnant smoke. All 22 soldiers suffered smoke inhalation and required hospitalization. One soldier subsequently died of complications from the smoke.

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**Pyrotechnics can kill. Commanders must set the safety rules through appropriate SOPs and stress adherence by teaching soldiers to give pyrotechnics their due respect.**

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- **Do** read and follow operating instructions.
- **Do** recognize that all pyrotechnic simulators contain hazardous materials.
- **Do** keep all simulators away from fires. Remember, photoflash powder ignites instantly.
- **Do** realize that pyrotechnics can cause irritation if smoke is inhaled or if residue gets on the skin.
- **Do** aim pyrotechnic simulators away from other people. A simulator thrown into a tent or vehicle causes injuries and property damage and can result in court martial.
- **Do** wear standard issue leather gloves on firing hand.
- **Do** give pyrotechnic simulators a lot of respect.

## Ammunition and weapons systems

These systems are extremely dangerous and must be handled with safety as the primary concern. Although no fatalities were recorded during the reporting period, these munitions have killed before and their misuse continues to cause serious injuries.

- The platoon was on line throwing grenades on command with a 1-second cookoff. Two soldiers standing about 1 meter apart were injured when a grenade exploded during the cookoff time before it was thrown.

- Two squads, about 150 meters apart, were involved in breaching operations with flares, artillery simulators, smoke pots, smoke grenades, and blanks. The attacking squad members were firing grenade launchers and 40mm practice rounds. Due to the dense smoke, one of the attackers apparently lost his bearings and fired into what he thought was dead space. An M203 round ricocheted off an obstacle and hit a soldier, fracturing his arm.

## Miscellaneous



Many other devices cause accidents. An explosive device in the hands of an untrained person creates a dangerous environment. Soldiers must be repeatedly cautioned as to the dangers of explosives and must not be allowed to tamper or experiment with explosive materials.

- An aggressor force looking for realism in their training decided to use civilian firecrackers instead of grenade simulators. One soldier, deciding to break open the firecrackers, spread the powder on the ground. When lit, it exploded in the soldier's face.

- A soldier opened an M80 blast simulator and poured the contents on the ground. When he lit the powder, he suffered a flash burn on his right hand that put him in the hospital for 8 days and on restricted duty for a month.

- The unconventional warfare (UCW) team had just completed a raid on the brigade supply area. As they were making their escape, the opposing team started firing star clusters at them. The first star cluster landed in front of the vehicle; however, the second landed in the truck bed, igniting some parkas on the floor. The UCW team members jumped from the truck to escape the intense heat just as the pyrotechnics on board started to go off. The truck and almost \$8,000 worth of equipment went up in flames.

- A soldier was making homemade explosives in his room. He was closing one end of a container with a hammer when the explosives went off. The blast amputated the end of his thumb and forefinger and damaged the tendons of his middle finger. The injuries this soldier caused himself totaled \$43,000.

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**Whether because of improper training, unsafe practices, or Murphy's Law, all of these accidents can be traced back to improper use of explosives materials. Commanders will have to be ever more vigilant in their efforts to track down these practices and wipe them out.**

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Five tactics have been proven to be the best tools at the commander's disposal:

- Commanders must establish safe performance criteria.
- Positive support for safety must come from higher headquarters.
- Operations have to be conducted by the book.
- Immediate enforcement action must be taken against violators of safe procedures.
- Strong command emphasis must be placed on training. Forces need not only to be ready; they must be safe and ready.

## **Recommended Manuals for Explosives and Demolitions**

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FM5-25, Explosives and Demolitions

FM5-34, Engineer Field Data

FM9-16, Explosive Ordnance Reconnaissance

FM23-30, Grenades and Pyrotechnic Signals

AR75-1, Malfunctions Involving Ammunition and Explosives

AR75-15, Responsibilities for Explosive Ordnance Disposal

AR385-63, Policies and Procedures for Firing Ammunition for Training, Target Practice, and Combat

AR385-64, Ammunition and Explosives Safety Standards

TM9-1300-200, Ammunition, General

TM9-1300-206, Ammunition and Explosives, Standards

TM9-1300-214, Military Explosives

TM9-1300-250, Ammunition Maintenance

TM9-1370-206-10, Pyrotechnic Signals

TM9-1370-207-10, Pyrotechnic Simulators, Operators Manual

TM9-1370-208-10, Photoflash Cartridges, Surface Flares, and Miscellaneous Pyrotechnic Items

TM9-1375-200/2, Use of Mine, Antitank

TM9-1375-213-12, Demolition Materials

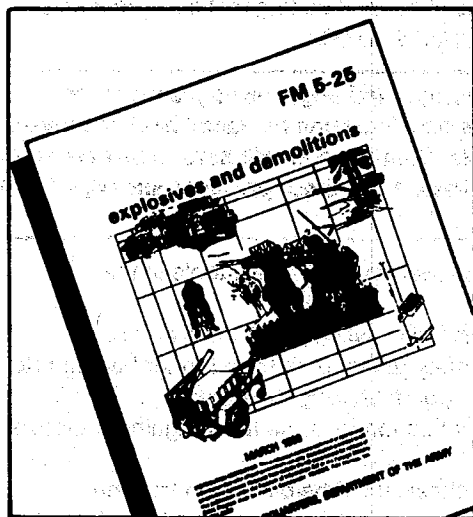
TM43-0001-37, Army Ammunition Data Sheets for Military Pyrotechnics

TM43-0001-38, Army Ammunition Data Sheets for Demolition Materials

GTA5-10-28, Demolition Card

## **Do's and Don'ts**

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Following is a list of Demolitions Do's and Don'ts that was prepared by the Demolitions Committee of the Engineer Center Fort Belvoir, Virginia.

The list is not intended to be all inclusive. Its purpose is to assist supervisors at all levels in their planning and execution of demolitions training. The list also serves as a ready reference for leaders who are checking demolition training plans and exercises. This list in no way substitutes for the requirement to reference the appropriate technical or field manual. Use of this list should always be in conjunction with FM5-25.

The conduct of live demolitions missions should only be attempted as a result of a thorough training program. Live demolitions must be executed by personnel with a sound knowledge and hands-on experience in demolition techniques and procedures.

Detailed technical inquiries regarding this list should be directed to U.S. Army Engineer Center, ATTN: ATZA-TE-FE, Fort Belvoir, VA 22060-5291, Autovon 354-6901.

# Demolition Don'ts

1. Don't connect blasting caps to det cord leads from the charge until all nonessential personnel have moved to a safe area. Only the person detailed to connect and fire the demolition, the instructor, and the RSO should remain behind.
2. Don't leave blasting caps unattended before or after attachment to the charge or firing wire.
3. Don't carry blasting caps or explosives in pockets.
4. Don't mix explosives and blasting caps of different manufacture.
5. Don't divide responsibility for demolition operations.
6. Don't conduct live demolition training or exercises during the approach or progress of an electrical storm.
7. Don't transport or store blasting caps with explosives.
8. Don't mix live explosives with inert or dummy material.
9. Don't bury time fuse or blasting caps or use in boreholes.
10. Don't let inexperienced personnel handle explosives.
11. Don't insert anything but time fuse or det cord into a nonelectric blasting cap.
12. Don't use old, deteriorated or damaged explosives.
13. Don't rush when working with explosives.
14. Don't place explosives where they will be exposed to flame, excessive heat, sparks or impact.
15. Don't attempt to fire electric blasting caps with less than the minimum current required.
16. Don't leave a vehicle containing explosive material unattended.
17. Don't take apart or alter the contents of any explosive materials.
18. Don't use aluminum wire in an electrical system.
19. Don't use electric blasting caps within 155 meters of an energized power line.
20. Don't twist time fuse inside the blasting cap.
21. Don't cut time fuse until you are ready to insert into the igniter and blasting cap.
22. Don't use the first and last 6 inches of any new or partially used roll of time fuse.
23. Don't violate the required safety distance rules.
24. Don't walk on det cord or firing wire.
25. Don't connect a blasting machine to firing wire through the unused portion of the drum. It must be kept as short as possible and cut to length.
26. Don't allow firing wire to form loops when laid on the ground.
27. Don't allow det cord to make any sharp bends or loops.
28. Don't attempt to carry out a mission or any aspect of a mission if you are unsure of what you are doing. Stop and obtain assistance.

# Demolition Do's

1. Always post guards to prevent access inside the danger radius.
2. Always use the minimum amount of explosives necessary to accomplish the mission.
3. Always use the minimum number of personnel necessary to accomplish the mission.
4. Supervisors must maintain control of the blasting machine.
5. The firing point end of firing wire must be guarded and kept disconnected and shunted until ready to fire.
6. Misfires should be checked by the OIC or RSO. If for some reason, they are unfamiliar with the setup of the demolition, the soldier who set the charge will accompany them, returning to the safe point when no longer required.
7. Keep flame producing devices at least 50 feet from vehicles carrying explosives.
8. Keep explosive materials away from food and eyes. Wash hands after handling.
9. Clear the immediate area of vehicles, equipment and extra explosive materials.
10. Ensure there are no foreign objects or moisture in a fuse lighter or blasting caps prior to inserting the time fuse.
11. Always conduct a test burn of at least three feet of time fuse to determine its burn rate.
12. Determine the length of time fuse required by walking the route to your safe point.
13. Use only M2 crimpers when cutting time fuse/det cord or when crimping.
14. Crimp blasting caps prior to placing in explosives.
15. Always sound adequate warning (non-wartime environment) prior to blast.
16. Always use nonsparking tools.
17. Always observe the minimum safe distances.
18. Remain in a safe area until the post blast fumes, dust and mists have subsided.
19. Always observe the minimum waiting time prior to investigating a misfire.
20. When taping a blasting cap to det cord, ensure  $\frac{1}{8}$  inch of the cap is clearly visible at both ends.
21. Remain in a safe area until the time has expired on all nonelectric systems and/or all firing wires have been connected to the blasting machine and fired (even if detonation has already occurred).
22. Always check firing wire for breaks and for continuity.
23. Firing wire should, whenever possible, be laid flat on the ground or buried.
24. Demolition circuits should, where possible, use blasting caps only to detonate det cord ring/line mains or branch lines if single charges.
25. All demolitions, dual or single primed, should be dual fired.
26. Connections between blasting cap leads and firing wire must be secured with insulating tape, not the cardboard spool.
27. When two nonelectric blasting caps are used to dual fire a demolition or to fire two separate charges, the time fuse will be cut to allow an interval of not less than 10 seconds between firings.
29. Do ask for assistance if you are unsure of what you are doing.

